US009445187B2

(12) **United States Patent**
Oh et al.

(10) **Patent No.: US 9,445,187 B2**
(45) **Date of Patent: *Sep. 13, 2016**

(54) **METHOD AND AN APPARATUS FOR PROCESSING AN AUDIO SIGNAL**

(71) Applicant: **LG Electronics Inc.**, Seoul (KR)

(72) Inventors: **Hyen O Oh**, Seoul (KR); **Yang Won Jung**, Seoul (KR)

(73) Assignee: **LG ELECTRONICS INC.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 252 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/107,940**

(22) Filed: **Dec. 16, 2013**

(65) **Prior Publication Data**

US 2014/0105422 A1 Apr. 17, 2014

Related U.S. Application Data

(63) Continuation of application No. 12/503,445, filed on Jul. 15, 2009, now Pat. No. 8,639,368.

(60) Provisional application No. 61/080,692, filed on Jul. 15, 2008.

(30) **Foreign Application Priority Data**

Jul. 15, 2009 (KR) 10-2009-0064274

(51) **Int. Cl.**
H04R 5/00 (2006.01)
H04R 3/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H04R 3/00*** (2013.01); ***G10L 19/008*** (2013.01); ***G10L 19/20*** (2013.01); ***H04S 7/30*** (2013.01); ***H04S 7/40*** (2013.01); *G10L 19/167* (2013.01)

(58) **Field of Classification Search**
CPC G10L 19/008; G10L 19/167; H04S 2420/03; H04S 3/008; H04S 2400/01
USPC 700/94; 381/21, 22, 23, 12
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,122,619 A * 9/2000 Kolluru G10L 19/008 704/270
7,613,306 B2 11/2009 Miyasaka et al.
(Continued)

FOREIGN PATENT DOCUMENTS

CN 1554098 A 12/2004
CN 1957640 A 5/2007
(Continued)

OTHER PUBLICATIONS

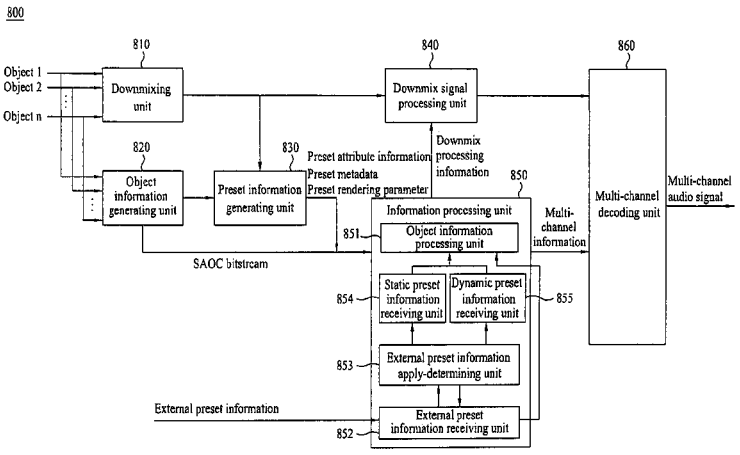
ID3 Draft Specification: Copyright Nov. 1, 2000.
(Continued)

Primary Examiner — Alexander Jamal
(74) *Attorney, Agent, or Firm* — Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

A method of processing an audio signal, the method including receiving a downmix signal and a first information, the downmix signal including at least one object, the first information including object information indicating an attribute of the at least one object; receiving a second information, the second information including external preset information and applied object number information, the external preset information being an external input and including an external preset rendering parameter and external preset metadata, the applied object number information indicating a number of objects to which the external preset information is applied; generating downmix processing information controlling panning or gain of the downmix signal by using the object information and the external preset information based on the applied object number information; and modifying the downmix signal by using the downmix processing information.

12 Claims, 17 Drawing Sheets



(51) **Int. Cl.**

G10L 19/008	(2013.01)
G10L 19/20	(2013.01)
H04S 7/00	(2006.01)
G10L 19/16	(2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,696,907	B2	4/2010	Pang et al.	
7,903,824	B2	3/2011	Faller et al.	
8,005,243	B2	8/2011	Terada et al.	
8,538,031	B2 *	9/2013	Purnhagen	H04R 5/00 381/23
2004/0237750	A1	12/2004	Smith et al.	
2006/0174267	A1	8/2006	Schmidt	
2007/0041278	A1	2/2007	Tsujimoto	
2007/0058033	A1	3/2007	Tsai et al.	
2007/0127733	A1	6/2007	Henn et al.	
2007/0206690	A1	9/2007	Sperschneider et al.	
2008/0049943	A1	2/2008	Faller et al.	
2008/0125044	A1	5/2008	Kim	
2008/0140426	A1	6/2008	Kim et al.	
2008/0205658	A1 *	8/2008	Breebaart	H04S 3/004 381/17
2009/0055005	A1	2/2009	Oxman et al.	
2009/0062944	A1	3/2009	Wood et al.	
2009/0164224	A1 *	6/2009	Fejzo	G10L 19/0017 704/500
2010/0076577	A1	3/2010	Lee et al.	
2010/0121647	A1	5/2010	Beack et al.	

FOREIGN PATENT DOCUMENTS

CN	101014999	A	8/2007
CN	101160618	A	4/2008
CN	101180674	A	5/2008
EP	1853092	A1	11/2007
EP	2083584	A1	7/2009
EP	2083585	A1	7/2009
JP	2000-209699	A	7/2000
KR	10-2004-0034370	A	4/2004
KR	10-2008-0063155	A	7/2008
WO	WO 2007/083957	A1	7/2007
WO	WO 2007/128523	A1	11/2007
WO	WO 2008/039038	A1	4/2008
WO	WO 2008/039041	A1	4/2008
WO	WO 2008/039043	A1	4/2008
WO	WO 2008/069593	A1	6/2008
WO	WO 2008/078973	A1	7/2008
WO	WO 2008/111770	A1	9/2008

OTHER PUBLICATIONS

Jung et al., "Personalized Music Service Based on Parametric Object Oriented Spatial Audio Coding" Proceedings AES 34th International Conference: "New Trends in Audio for Mobile and Handheld Devices" Aug. 28, 2008, pp. 1-5, XP002547897.

SAOC: MPEG 2007: Call for Proposals on Spatial Audio Object Coding: Copyright 2007.

Taejin Lee et al., "A Personalized Preset-based Audio System for Interactive Service" Audio Engineering Society Convention Paper, New York, US, No. 6904, Oct. 5, 2006, pp. 1-6, XP002531682.

* cited by examiner

FIG. 1A

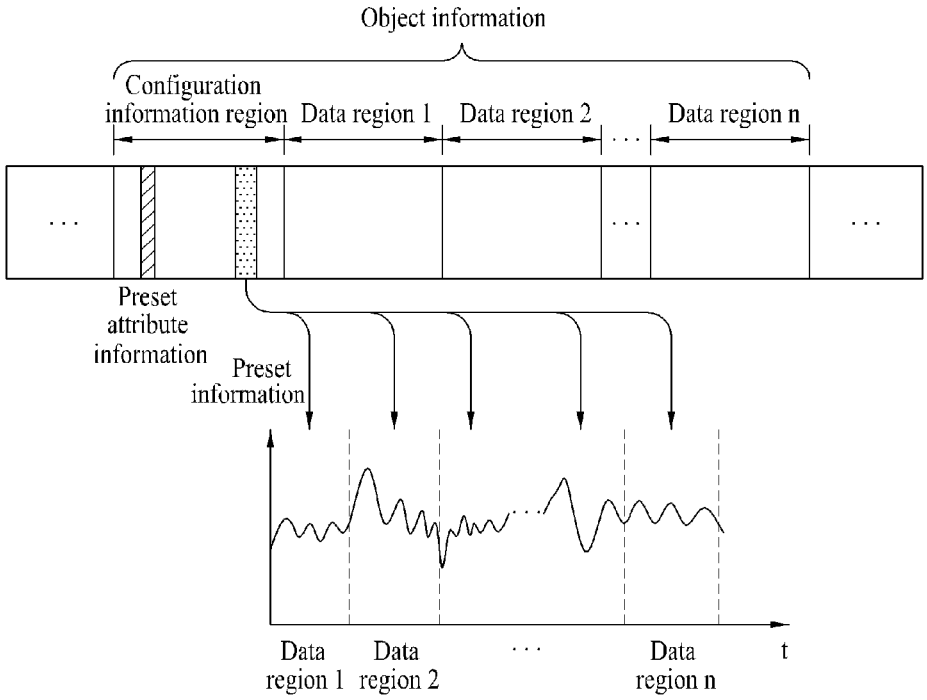

Object information
Configuration information region
Data region 1
Data region 2
Data region n
Preset attribute information
Preset information
Data region 1
Data region 2
Data region n
t

FIG. 1B

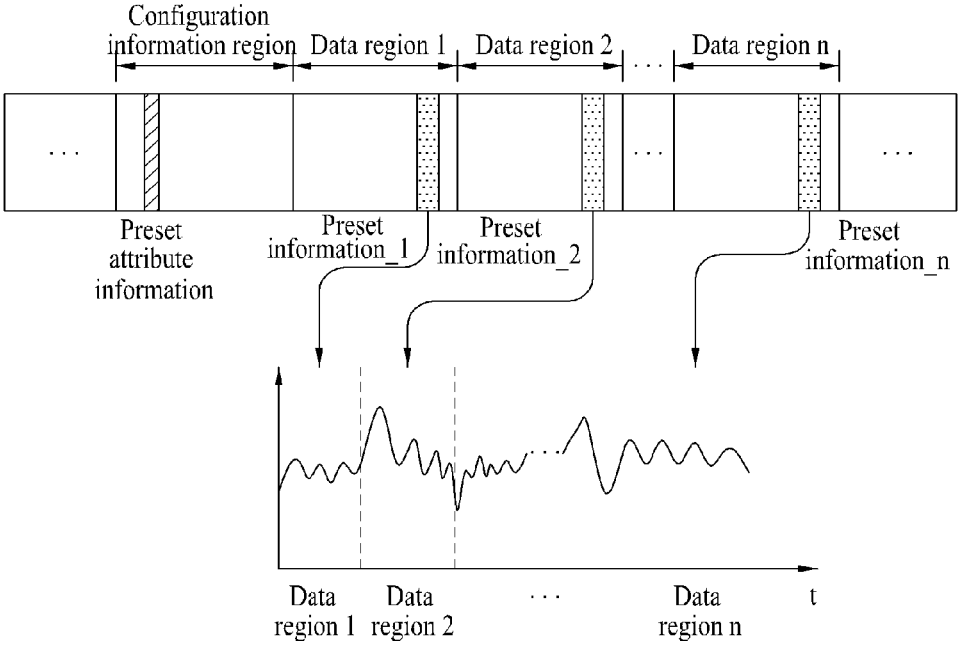

Configuration information region
Data region 1
Data region 2
Data region n
Preset attribute information
Preset information_1
Preset information_2
Preset information_n
Data region 1
Data region 2
Data region n
t

FIG. 2

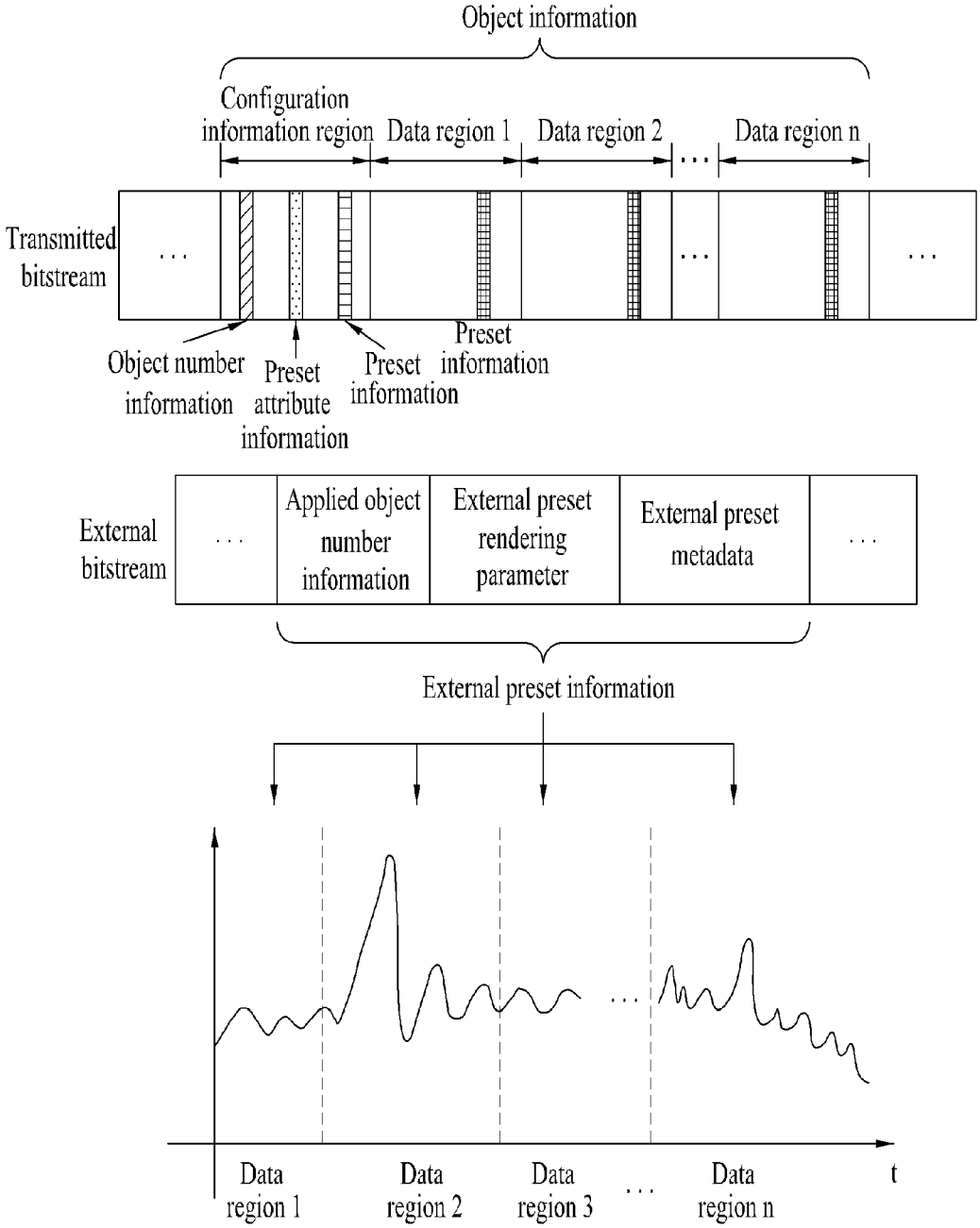

Object information
Configuration information region
Data region 1
Data region 2
Data region n
Transmitted bitstream
Object number information
Preset attribute information
Preset information
Preset information
External bitstream
Applied object number information
External preset rendering parameter
External preset metadata
External preset information
Data region 1
Data region 2
Data region 3
Data region n
t

FIG. 3

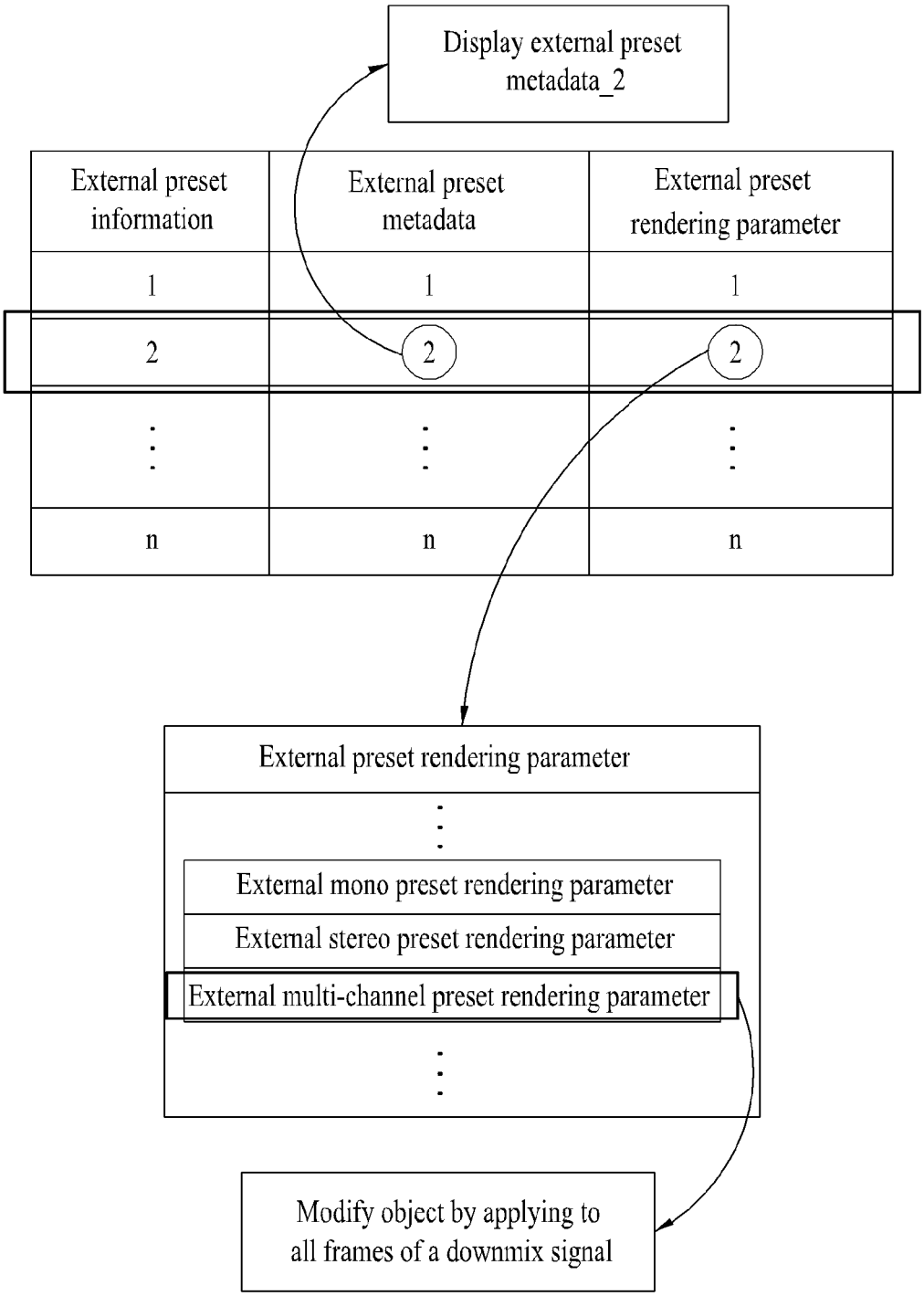

Display external preset metadata_2
External preset information
External preset metadata
External preset rendering parameter
1
1
1
2
2
2
n
n
n
External preset rendering parameter
External mono preset rendering parameter
External stereo preset rendering parameter
External multi-channel preset rendering parameter
Modify object by applying to all frames of a downmix signal

FIG. 4

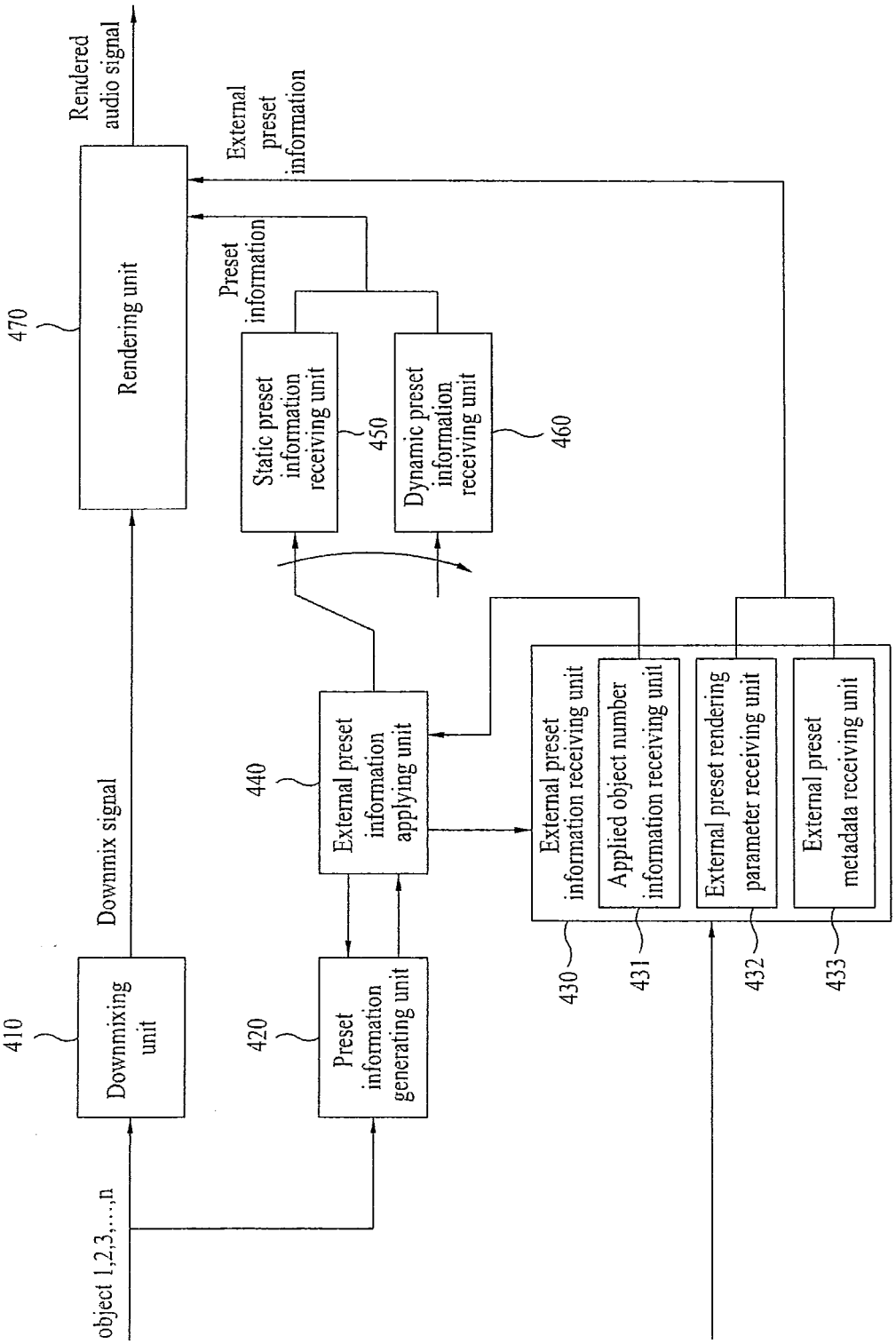

object 1,2,3,...,n
410
Downmixing unit
Downmix signal
420
Preset information generating unit
440
External preset information applying unit
430
External preset information receiving unit
431
Applied object number information receiving unit
432
External preset rendering parameter receiving unit
433
External preset metadata receiving unit
450
Static preset information receiving unit
460
Dynamic preset information receiving unit
Preset information
470
Rendering unit
External preset information
Rendered audio signal

FIG. 5A

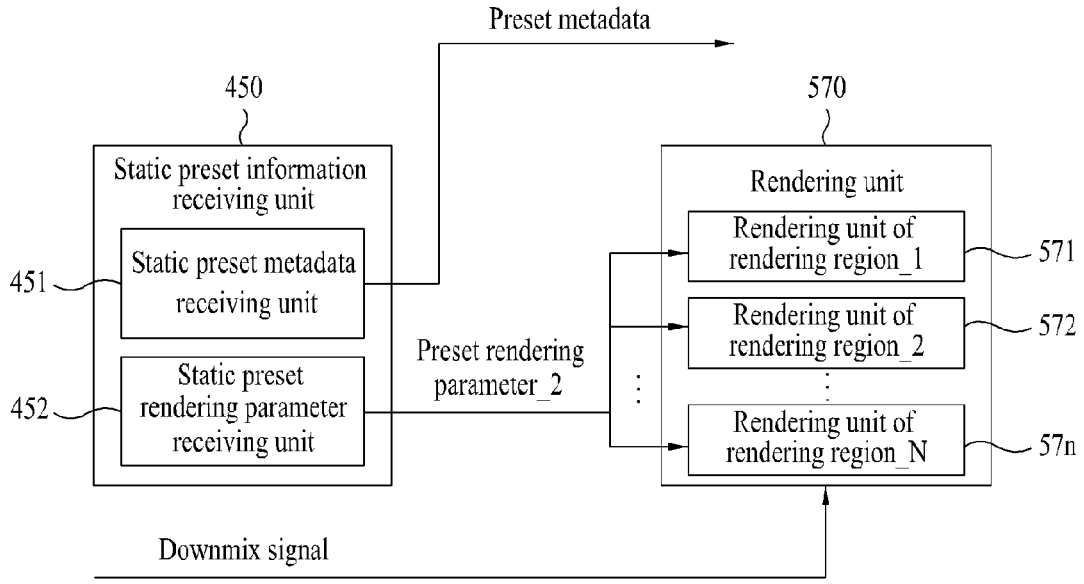

Preset metadata
450
570
Static preset information receiving unit
Static preset metadata receiving unit
451
Static preset rendering parameter receiving unit
452
Preset rendering parameter_2
Rendering unit
Rendering unit of rendering region_1
571
Rendering unit of rendering region_2
572
Rendering unit of rendering region_N
57n
Downmix signal

FIG. 5B

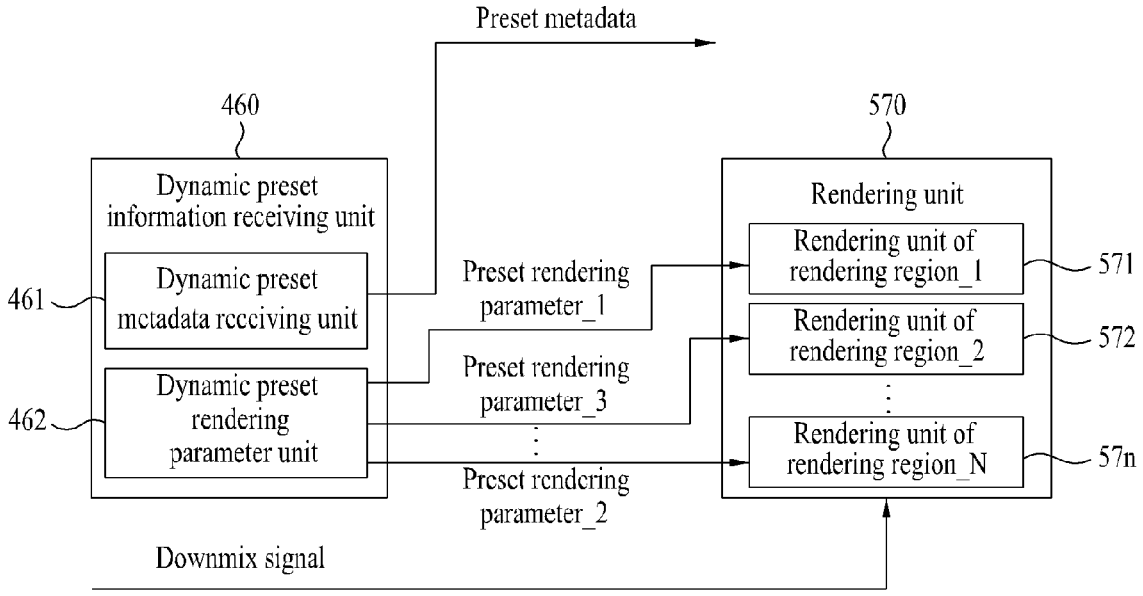

Preset metadata
460
570
Dynamic preset information receiving unit
Dynamic preset metadata receiving unit
461
Dynamic preset rendering parameter unit
462
Preset rendering parameter_1
Preset rendering parameter_3
Preset rendering parameter_2
Rendering unit
Rendering unit of rendering region_1
571
Rendering unit of rendering region_2
572
Rendering unit of rendering region_N
57n
Downmix signal

FIG. 6

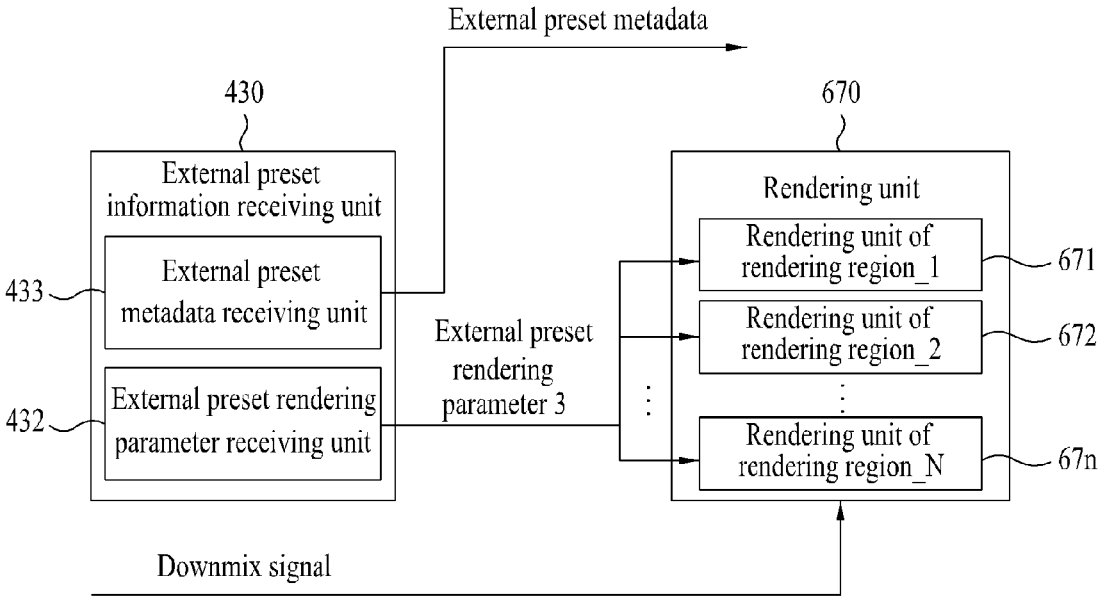

External preset metadata
430
670
External preset information receiving unit
External preset metadata receiving unit
433
External preset rendering parameter receiving unit
432
External preset rendering parameter 3
Rendering unit
Rendering unit of rendering region_1
671
Rendering unit of rendering region_2
672
Rendering unit of rendering region_N
67n
Downmix signal

FIG. 7

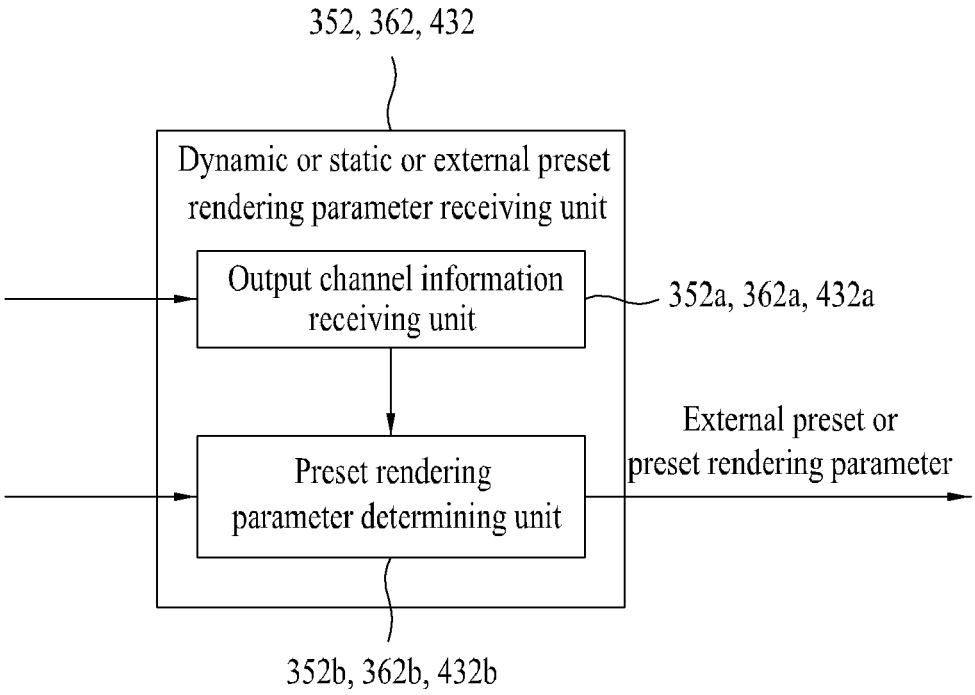

352, 362, 432
Dynamic or static or external preset rendering parameter receiving unit
Output channel information receiving unit
352a, 362a, 432a
Preset rendering parameter determining unit
External preset or preset rendering parameter
352b, 362b, 432b

FIG. 8

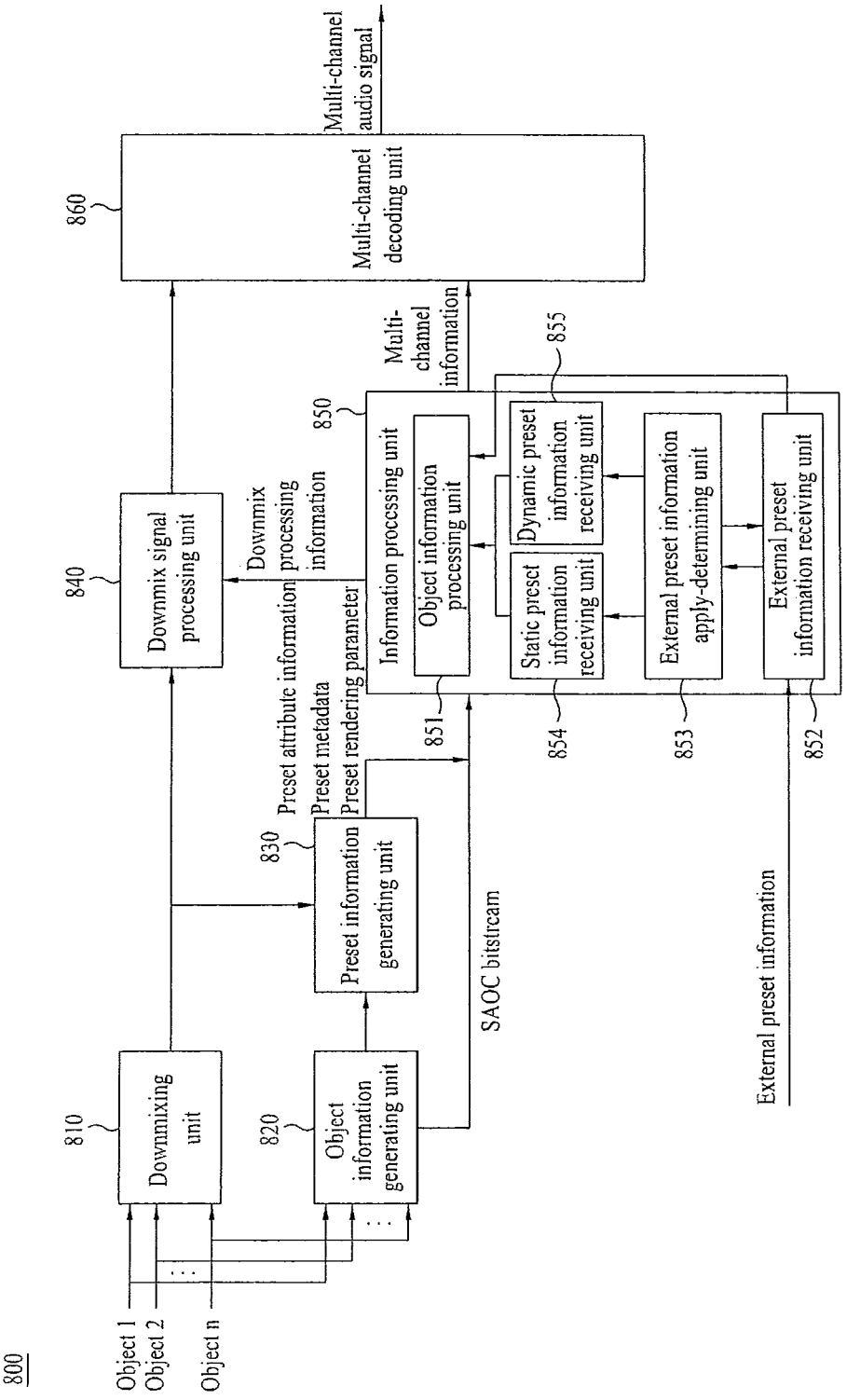

800
Object 1
Object 2
Object n
810
Downmixing unit
820
Object information generating unit
830
Preset information generating unit
Preset attribute information
Preset metadata
Preset rendering parameter
SAOC bitstream
840
Downmix signal processing unit
Downmix processing information
850
Information processing unit
Object information processing unit
Static preset information receiving unit
Dynamic preset information receiving unit
External preset information apply-determining unit
External preset information receiving unit
851
852
853
854
855
Multi-channel information
860
Multi-channel decoding unit
Multi-channel audio signal
External preset information

FIG. 9

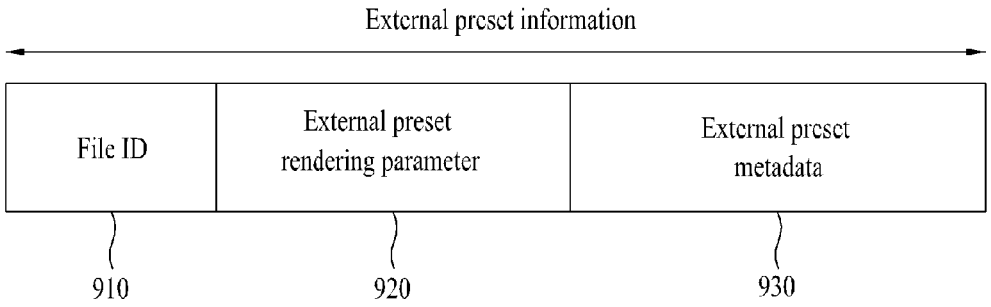

External preset information
File ID
External preset rendering parameter
External preset metadata
910
920
930

FIG. 10

Syntax	No.of bits	Mnemonic

SAOCSpecificConfig()
{
bsSamplingFrequencyIndex;
⋮
ByteAlign();
SAOCExtensionConfig();
}
	4	uimsbf

Syntax	No.of bits	Mnemonic

SAOCExtensionConfigData(9)
{
PresetConfig();
}		

Syntax	No.of bits	Mnemonic

PresetConfig()
{
bsNumPresets;
for (i=0; i<bsNumPresets+1; i++) {
bsNumCharPresetLabel[i];
for (j=0; j<bsNumCharPresetLabel[i]; j++) {
bsPresetLabel[i][j];
}
bsPresetMatrix;
If (bsPresetMatrix) {
PresetMatrixData();
} else {
PresetUserData();
}
}
}
	4
	
	8
	
	8
	
	1
		uimsbf
		
		uimsbf
		
		bslbf
		
		uimsbf

FIG. 11

Syntax	No.of bits	Mnemonic

SAOCFrame()
{
FramingInfo();
⋮
ByteAlign();
SAOCExtensionFrame();
}
		Note 1

Note 1: FramingInfo() is defined in ISO/IEC FDIS 23003-1 : 2006, Table 16 Note 2: EcData() is defined in ISO/IEC FDIS 23003-1 : 2006, Table 23		

Syntax	No.of bits	Mnemonic

SAOCExtensionFrame(9)
{
for (i=0; i<bsNumPresets−1; i++) {
if (bsPresetMatrix) {
PresetMatrixData();
} else {
PresetUserData();
}
}		

Syntax	No.of bits	Mnemonic

PresetMatrixData()
{
bsPresetMatrixType;
for (i=0; i<numObjects; i++) {
numChannels = PresetMatrixType[bsPresetMatrixType];
for (j=0; j<numChannels; i++) {
bsPresetMatrixElements[i][j];
}
}
}
	2
	
	4
		uimsbf
		
		uimsbf

FIG. 12

Syntax	No.of bits	Mnemonic

SAOCExtensionFrame(9)
{
for (i=0; i<bsNumPresets+1; i++) {
if(bsPresetMatrix){
for (i=0; i<numObjects; i++) {
for (j=0; j<numChannels; i++) {
bsPresetMatrixElements[i][j];
}
}
} else {
PresetUserDataContainer(bsPresetUserDataIdentifier);
}
}
}
	4	uimsbf

FIG. 13

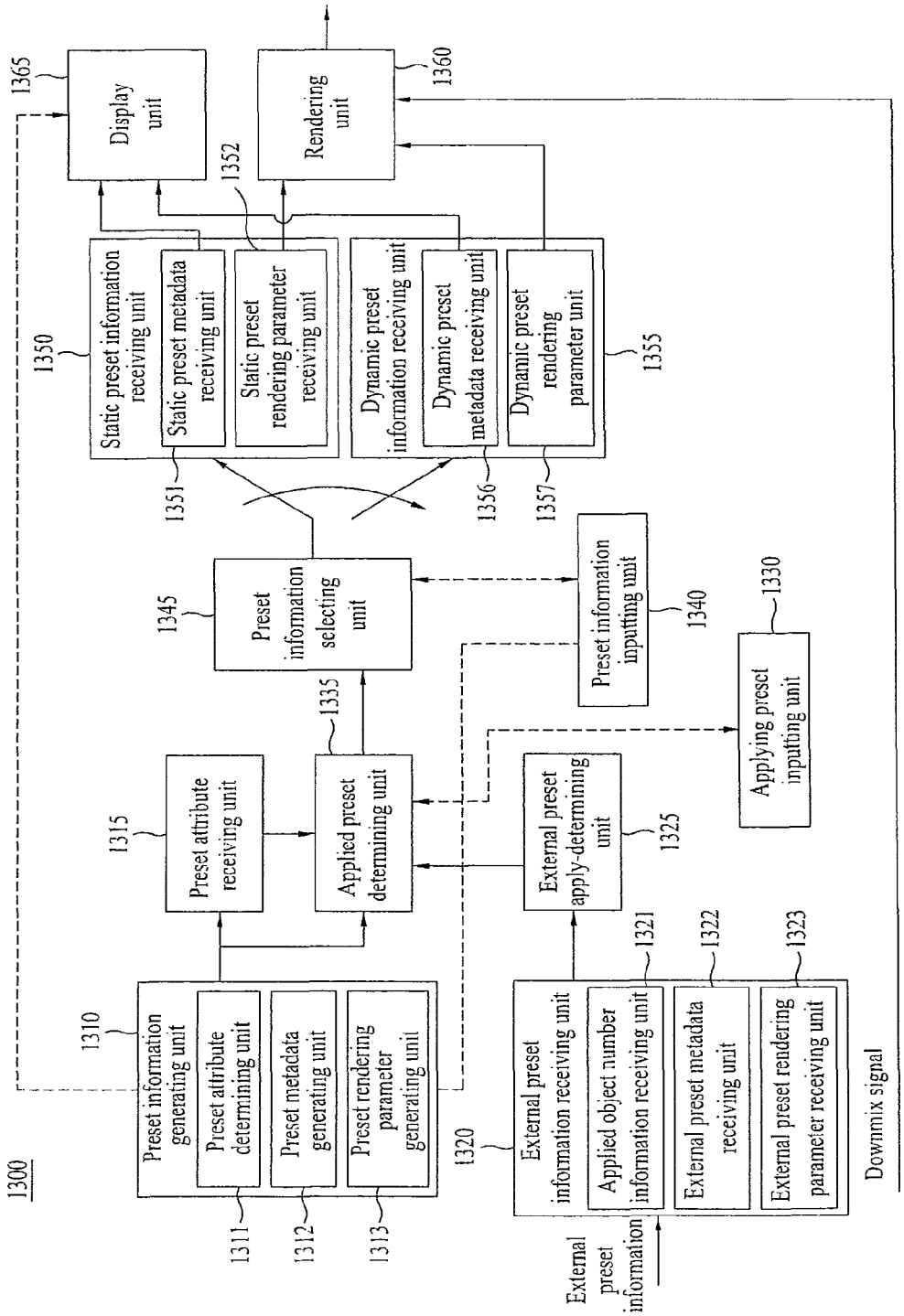

1300
Preset information generating unit
1310
Preset attribute determining unit
1311
Preset metadata generating unit
1312
Preset rendering parameter generating unit
1313
Preset attribute receiving unit
1315
Applied preset determining unit
1335
External preset information receiving unit
1320
Applied object number information receiving unit
1321
External preset metadata receiving unit
1322
External preset rendering parameter receiving unit
1323
External preset apply-determining unit
1325
External preset information
Preset information selecting unit
1345
Preset information inputting unit
1340
Applying preset inputting unit
1330
Static preset information receiving unit
1350
Static preset metadata receiving unit
1351
Static preset rendering parameter receiving unit
1352
Dynamic preset information receiving unit
1356
Dynamic preset metadata receiving unit
1357
Dynamic preset rendering parameter unit
1355
Display unit
1365
Rendering unit
1360
Downmix signal

FIG. 14

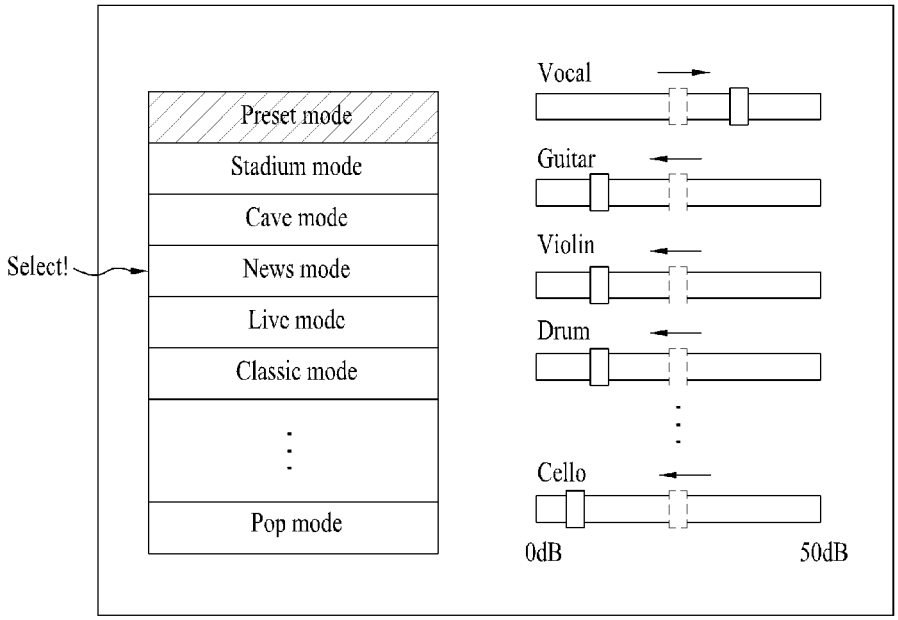

Preset mode
Stadium mode
Cave mode
Select!
News mode
Live mode
Classic mode
Pop mode
Vocal
Guitar
Violin
Drum
Cello
0dB
50dB

FIG. 15

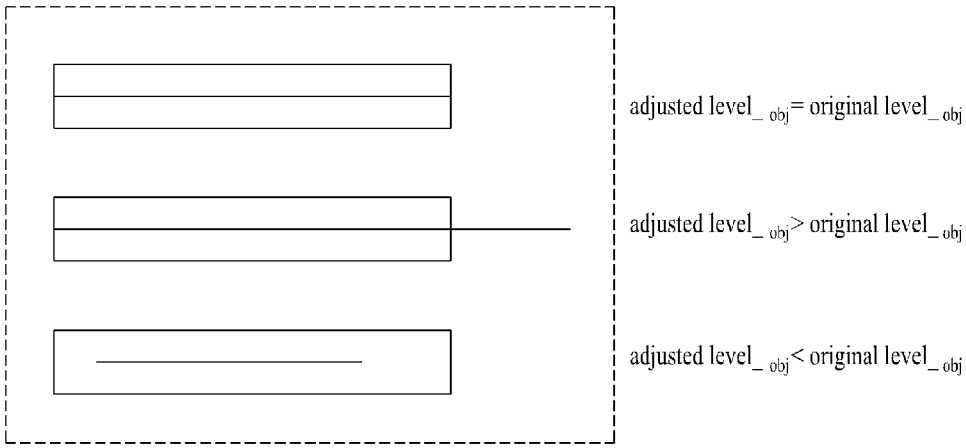

adjusted level_obj = original level_obj
adjusted level_obj > original level_obj
adjusted level_obj < original level_obj

FIG. 16

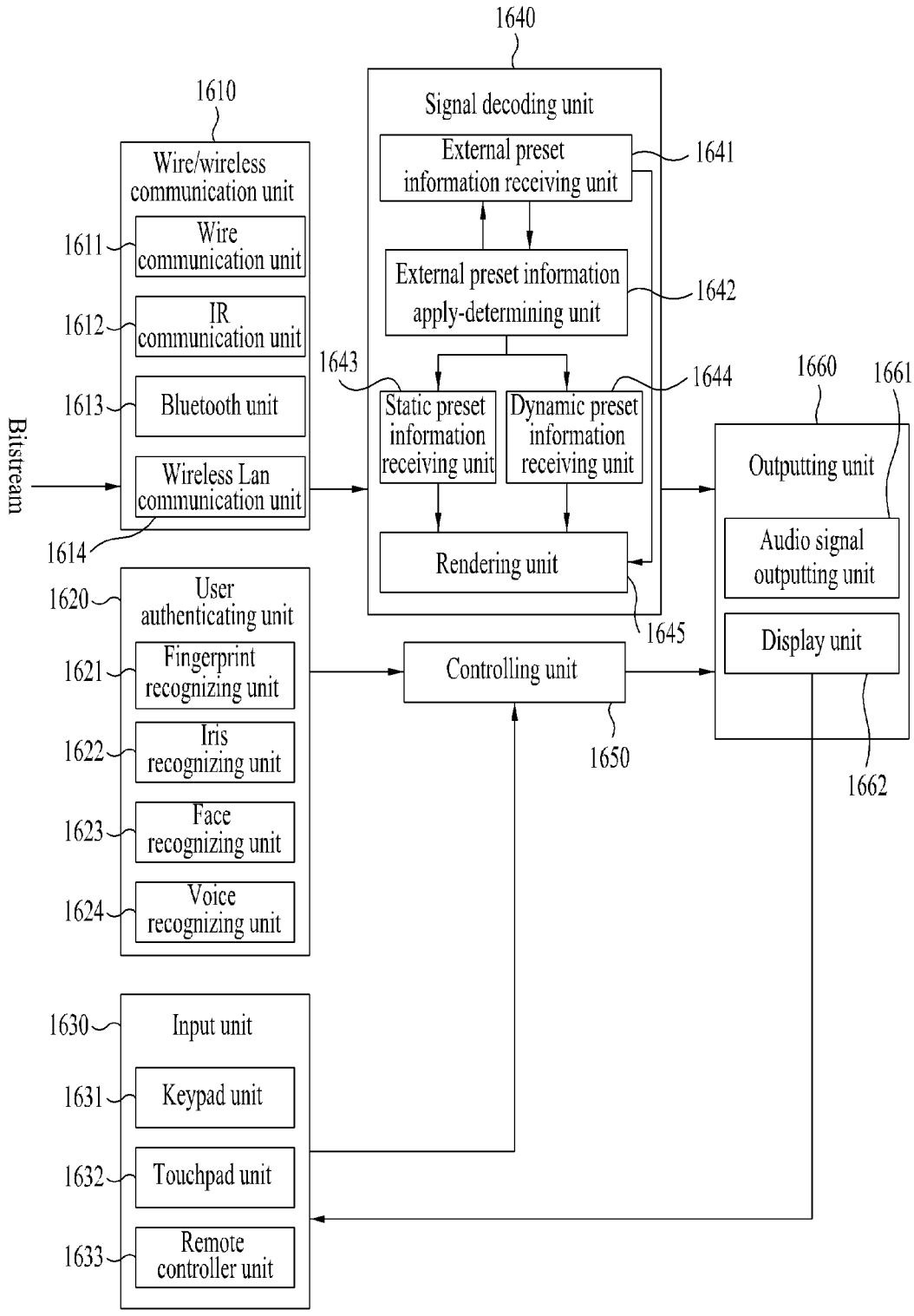

1640
Signal decoding unit
1610
Wire/wireless communication unit
External preset information receiving unit
1641
1611
Wire communication unit
External preset information apply-determining unit
1642
1612
IR communication unit
1643
1644
1660
1661
1613
Bluetooth unit
Static preset information receiving unit
Dynamic preset information receiving unit
Outputting unit
Bitstream
Wireless Lan communication unit
Audio signal outputting unit
1614
Rendering unit
1620
User authenticating unit
1645
Display unit
1621
Fingerprint recognizing unit
Controlling unit
1622
Iris recognizing unit
1650
1662
1623
Face recognizing unit
1624
Voice recognizing unit
1630
Input unit
1631
Keypad unit
1632
Touchpad unit
1633
Remote controller unit

FIG. 17A

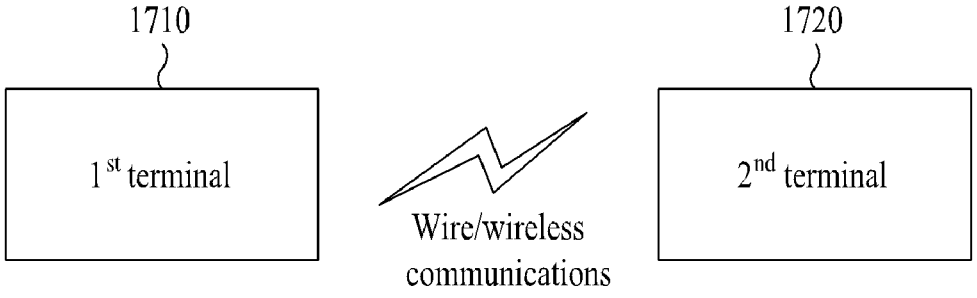


FIG. 17B

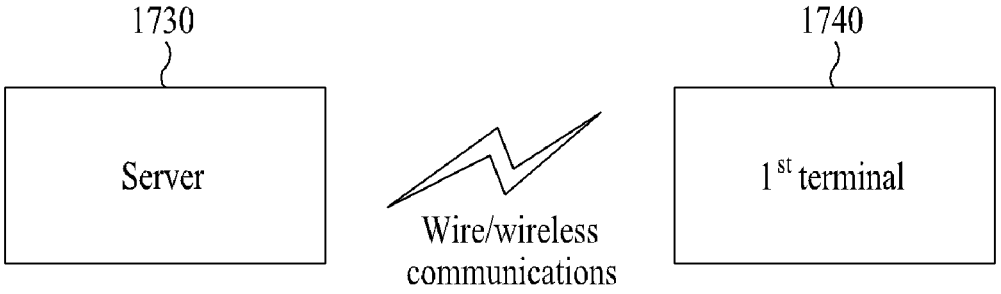
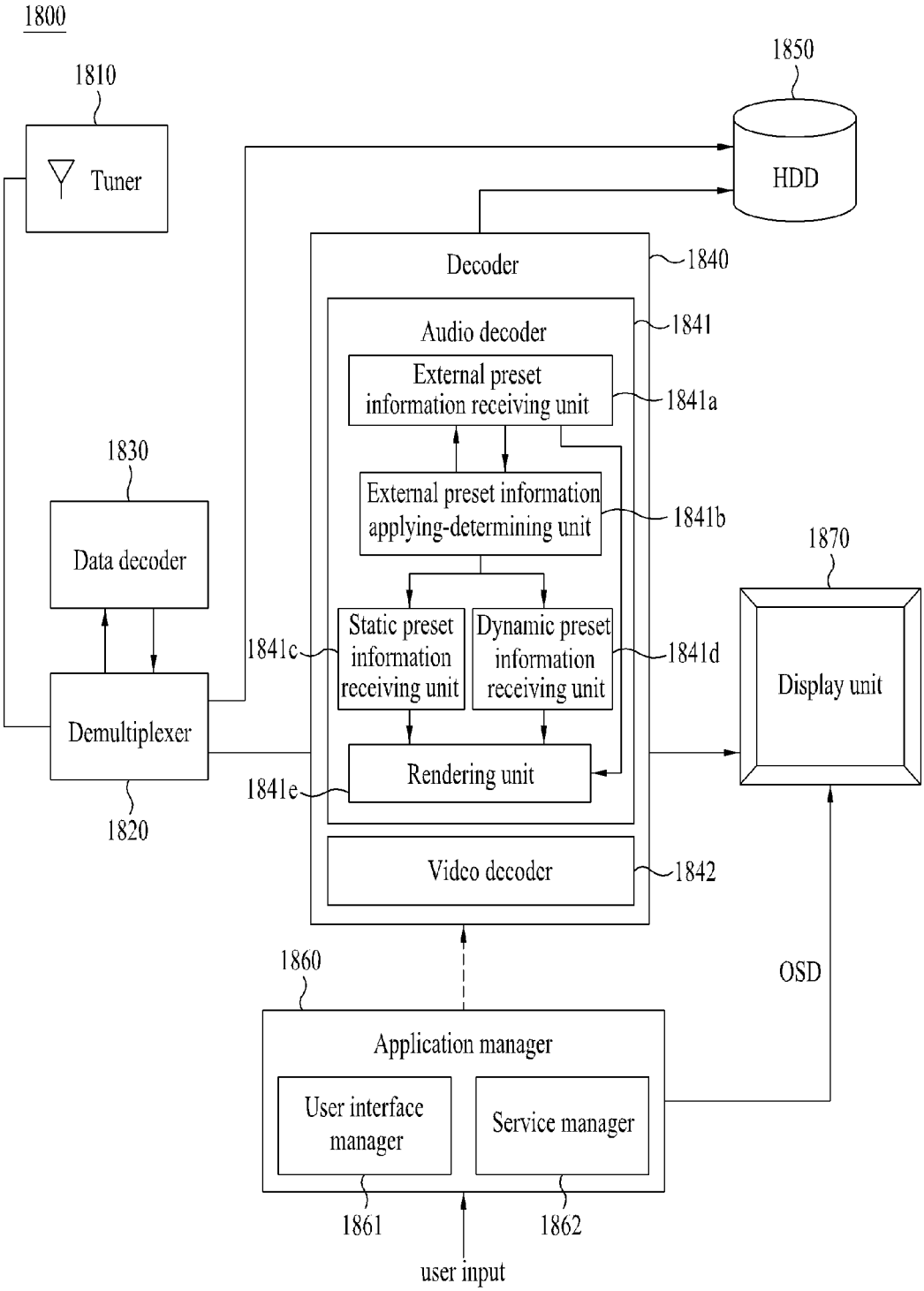


FIG. 18


1800
1810
Tuner
1850
HDD
Decoder
1840
Audio decoder
1841
External preset information receiving unit
1841a
External preset information applying-determining unit
1841b
1830
Data decoder
1870
Display unit
1841c
Static preset information receiving unit
Dynamic preset information receiving unit
1841d
Demultiplexer
1820
1841e
Rendering unit
Video decoder
1842
1860
OSD
Application manager
User interface manager
Service manager
1861
1862
user input

METHOD AND AN APPARATUS FOR PROCESSING AN AUDIO SIGNAL

CROSS-REFERENCE TO RELATED APPLICATION

This application is a Continuation of copending U.S. application Ser. No. 12/503,445, filed on Jul. 15, 2009, which claims priority to Korean Application No. 10-2009-0064274, filed on Jul. 15, 2009, and which claims priority to U.S. Provisional Application No. 61/080,692, filed on Jul. 15, 2008. The entire contents of all of the above applications are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to audio signal processing, and more particularly, to an apparatus for processing an audio signal and method thereof. Although the present invention is suitable for a wide scope of applications, it is particularly suitable for processing an audio signal received via a digital medium, a broadcast signal or the like.

2. Discussion of the Related Art

Generally, in a process for generating a downmix signal by downmixing an audio signal including a plurality of objects into a mono or stereo signal, parameters (or information) are extracted from the objects. Theses parameters (or information) are used in decoding the downmixed signal. And, positions and gains of the objects can be controlled by a selection made by a user as well as the parameters.

However, objects included in a downmix signal should be controlled by a user's selection. In case that a user controls an object, it is inconvenient for the user to directly control all object signals. And, it may be more difficult to reproduce an optimal state of an audio signal including a plurality of objects than a case that an expert controls objects.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to an apparatus for processing an audio signal and method thereof that substantially obviate one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention is to provide an apparatus for processing an audio signal and method thereof, by which a level and position of an object can be controlled using preset information including a preset rendering parameter and preset metadata.

Another object of the present invention is to provide an apparatus for processing an audio signal and method thereof, by which a level and position of an object can be controlled using external preset information included in a bitstream inputted separate from a downmix signal.

Another object of the present invention is to provide an apparatus for processing an audio signal and method thereof, by which an object included in a downmix signal can be controlled by applying external preset information carried on a bitstream inputted separate from the downmix signal to a whole downmix or a data region of the downmix signal using preset attribute information indicating an attribute of preset information inputted together with the downmix signal according to a characteristic of an audio source.

Another object of the present invention is to provide an apparatus for processing an audio signal and method thereof, by which a level and position of an object can be controlled using an external preset rendering parameter corresponding to one selected from a plurality of external preset metadatas displayed on a screen based on a selection made by a user.

A further object of the present invention is to provide an apparatus for processing an audio signal and method thereof, by which feedback information can be received from a user in a manner of displaying an object controlled by having an external preset rendering parameter applied thereto and selected external preset metadata on a screen.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. **1**A and FIG. **1**B are diagrams for a concept of adjusting an object included in a downmix signal by applying preset information according to preset attribute information according to one embodiment of the present invention;

FIG. **2** is a diagram for a concept of adjusting an object included in a downmix signal using external preset information according to preset attribute information according to one embodiment of the present invention;

FIG. **3** is a diagram for a concept of external preset information applied to an object included in a downmix signal;

FIG. **4** is a block diagram of an audio signal processing apparatus according to one embodiment of the present invention;

FIG. **5**A and FIG. **5**B are block diagrams for schematic configurations of a static preset information receiving unit, a dynamic preset information receiving unit and a rendering unit according to one embodiment of the present invention;

FIG. **6** is a block diagram for a schematic configuration of an external preset information receiving unit and a rendering unit according to one embodiment of the present invention;

FIG. **7** is a block diagram for a schematic configuration of a preset rendering parameter receiving unit shown in one of FIGS. **5**A to **6**;

FIG. **8** is a block diagram of an audio signal processing apparatus according to one embodiment of the present invention;

FIG. **9** is a diagram for a bitstream structure of external preset information;

FIGS. **10** to **12** are various diagrams for syntax related to preset invention according to another embodiment of the present invention;

FIG. **13** is a block diagram of an audio signal processing apparatus according to another embodiment of the present invention;

FIG. **14** is a diagram for a display unit of an audio signal processing apparatus according to another embodiment of the present invention;

FIG. **15** is a diagram for at least one diagrammatic object displaying objects having external preset information applied thereto according to another embodiment of the present invention;

FIG. **16** is a schematic diagram of a product including an external preset information receiving unit, an external preset information applying-determining unit, a static preset information receiving unit, a dynamic preset information receiving unit and a rendering unit according to another embodiment of the present invention;

FIG. **17**A and FIG. **17**B are schematic diagrams for relations of products, each of which includes an external preset information receiving unit, an external preset information applying-determining unit, a static preset information receiving unit, a dynamic preset information receiving unit and a rendering unit, according to another embodiment of the present invention; and

FIG. **18** is a schematic block diagram of a broadcast signal decoding apparatus including an external preset information receiving unit, an external preset information applying-determining unit, a static preset information receiving unit, a dynamic preset information receiving unit and a rendering unit according to a further embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. First of all, terminologies in the present invention can be construed as the following references. And, terminologies not disclosed in this specification can be construed as the following meanings and concepts matching the technical idea of the present invention. Therefore, the configuration implemented in the embodiment and drawings of this disclosure is just one most preferred embodiment of the present invention and fails to represent all technical ideas of the present invention. Thus, it is understood that various modifications/variations and equivalents can exist to replace them at the timing point of filing this application.

In this disclosure, 'information' is the terminology that generally includes values, parameters, coefficients, elements and the like and its meaning can be construed as different occasionally, by which the present invention is non-limited.

FIG. **1**A and FIG. **1**B are diagrams for a concept of adjusting an object included in a downmix signal by applying preset information according to preset attribute information according to one embodiment of the present invention. An audio signal of the present invention is encoded into a downmix signal and object information by an encoder. The downmix signal or the object information is transferred to a decoder by being carried on a single bitstream or an individual bitstream. The preset information is included in object information and indicates the information that was previously set to adjust a level, panning or the like of an object included in a downmix signal. The preset information can include various modes and is able to include rendering parameters for actually adjusting an object and metadatas indicating a characteristic of a corresponding mode. This will be explained in detail with reference to FIG. **2** and FIG. **3** later.

Referring to FIG. **1**A and FIG. **1**B, object information included in a bitstream particularly includes a configuration information region and a plurality of data regions (data region **1**, data region **2**, . . . data region n). The configuration information region is a region located at a fore part of a bitstream of object information and contains informations applied in common to all data regions of the object information. For instance, the configuration region information can contain configuration information including a tree structure and the like, data region length information, object number information and the like.

On the contrary, the data region is a unit generated from dividing a time domain of a whole audio signal based on the data region length information contained in the configuration information region and is able to include a frame. The data region of the object information corresponds to a data region of the downmix signal and contains such object data information as object level information based on the attribute of the object of the corresponding data region, object gain information and the like.

In an audio signal processing method according to one embodiment of the present invention, preset attribute information (preset_attribute_information) is read from object information of a bitstream. The preset attribute information indicates that preset information is included in which region of a bitstream. In particular, the preset attribute information indicates whether preset information is included in a configuration information region of the object information or a data region of the object information and its detailed meanings are shown in Table 1.

TABLE 1

Preset attribute information (preset_attribute_information)	Meaning
0	Preset information is included in a configuration information region.
1	Preset information is included in a data region.

Referring to FIG. **1**A, if preset attribute information is set to **0** to indicate that preset information is included in a configuration information region, rendering is performed in a manner that preset information extracted from the configuration information region is equally applied to all data regions of a downmix signal.

On the contrary, referring to FIG. **1**B, if preset attribute information is set to 1 to indicate that preset information is included in a data region, rendering is performed in a manner that preset information extracted from the data region is equally applied to a corresponding data region of a downmix signal. For instance, preset information extracted from a data region **1** is applied to a downmix signal of the data region **1**. And, preset information extracted from a data region n is applied to a downmix signal of the data region n.

Moreover, the preset attribute information is able to indicate whether the preset information is static or dynamic. When preset attribute information is set to 0, if preset information is included in a configuration information region, it is able to call that the preset information is static. In this case, the preset information is statically and equally applied to all data regions.

On the contrary, when preset attribute information is set to 1, if preset information is included in a data region, it is able to call that the preset information is dynamic. In this case, since the preset information is applied to a corresponding data region only to render a downmix signal of the corresponding data region, the preset information is dynamically applied per data region. In this case, if the preset information is dynamic, it is preferable that the preset information exists in an extension region of the data region. If the preset information is static, it is preferable that the preset information exists in an extension region of the configuration information region.

Therefore, an audio signal processing method according to one embodiment of the present invention is able to render a downmix signal in a manner of using preset information suitable for each data region according to a characteristic of an audio source by preset attribute information or applying the same preset information to all data regions.

FIG. **2** is a diagram for a concept of adjusting an object included in a downmix signal using external preset information according to preset attribute information according to one embodiment of the present invention.

First of all, an audio signal of the present invention is encoded into a downmix signal and object information. As mentioned in the foregoing description with reference to FIG. **1**A and FIG. **1**B, the downmix signal and the object information are transferred as one bitstream or individual bitstreams to a decoder. In this case, the object information of the transferred bitstream can further include object number information indicating the number of object included in the downmix signal as well as preset attribute information and preset information.

Meanwhile, external preset information is externally inputted as an external bitstream to the decoder (not from the encoder) as well as the preset information included in the object information transferred from the encoder to render the downmix signal. As a set of information previously set to adjust the object, preset information inputted not from the encoder but from an external environment is named external preset information in this disclosure. The external preset information included in the external bitstream can include an external preset rendering parameter for adjusting a gain and/or panning of an object and external preset parameter indicating an attribute of the external preset rendering parameter. Moreover, the external bitstream can further include applied object number information indicating the number of objects included in the downmix signal, to which the external preset information will be applied, and external metadata information indicating whether the external preset information is used or not.

It is able to determine whether the external preset information or the preset information will be used using the object number information and the applied object number information. This will be explained in detail with reference to FIG. **4** later. If it is determined to use the external preset information, the object can be adjusted in a manner that the external preset information is equally and statically applied to all data regions of the downmix signal.

FIG. **3** is a diagram for a concept of external preset information applied to an object included in a downmix signal.

First of all, the external preset information can be represented in various modes that can be selected according to a characteristic of an audio signal or a listening environment. And, there can exist at least one external preset information. Moreover, the external preset information can include an external preset rendering parameter applied to adjust the object and external preset metadata to represent an attribute of the external preset rendering parameter and the like. It is able to represent the external preset metadata in a text form. The external preset metadata can indicate an attribute of the external preset information as well as an attribute (e.g., a concert hall mode, a karaoke mode, a news mode, etc.) of the external preset rendering parameter.

The external preset metadata can include such relevant information for representing the external preset rendering parameter as a writer of the external preset rendering parameter, a written date of the external preset rendering parameter, a name of an object having the external preset rendering parameter applied thereto and the like, file extension information indicating a file format of preset information and the like. Meanwhile, the external preset rendering parameter is the data that is substantially applied to the object and can be represented in various forms (e.g., matrix) to correspond to the external preset metadata.

Referring to FIG. **3**, external preset information **1** may correspond to a concert hall mode for providing a sound stage effect that enables a listener to hear a music signal as if the listener is in a concert hall. External preset information **2** can be a karaoke mode for reducing a level of a vocal object in an audio signal. And, external preset information n can be a news mode for raising a level of a speech object. Moreover, the external preset information includes external preset metadata and an external preset rendering parameter. If a user selects the external preset information **2**, the karaoke mode corresponding to the external preset metadata **2** will be displayed on a display unit. And, it is able to adjust a level by applying the external preset information **2** relevant to the external preset metadata **2** to the object.

In this case, the external preset rendering parameter can include a mono external preset rendering parameter, a stereo external preset rendering parameter and a multi-channel external preset rendering parameter. The external preset rendering parameter is determined according to a final output channel of an object (or, a final output channel of a downmix signal including an object). The mono external preset rendering parameter is the external preset rendering parameter applied if an output channel of the object is mono. The stereo external preset rendering parameter is the external preset rendering parameter applied if an output channel of the object is stereo. And, the multi-channel external preset rendering parameter is the external preset rendering parameter applied if an output channel of the object is a multi-channel. Once an output channel of the object is determined according to configuration information, a type of the external preset rendering parameter is determined using the determined output channel. It is then able to adjust an object included in the downmix signal by applying the external preset rendering parameter to all data regions.

FIG. **4** is a block diagram of an audio signal processing apparatus **400** according to one embodiment of the present invention.

Referring to FIG. **4**, an audio signal processing apparatus **400** can include a downmixing unit **410**, a preset information generating unit **420**, an external preset information receiving unit **430**, an external preset information applying-determining unit **440**, a static preset information receiving unit **450**, a static preset information receiving unit **450**, a dynamic preset information receiving unit **460** and a rendering unit **470**.

The downmixing unit **410** receives at least one or more objects object **1**, object **2**, object **3**, . . . , object n and then generates a downmix signal by downmixing the received at least one or more objects. In this case, the object means a source and can include vocal, guitar, piano or the like. The number of channels of the downmix signal is smaller than that of inputted signals. And, the downmix signal can include all of the objects.

The preset information generating unit **420** generates preset information for adjusting an object included in an audio signal in case of rendering and is able to generate a preset rendering parameter, preset information and preset attribute information indicating an attribute of the preset information. The preset information generating unit **420** can include a preset attribute determining unit, a preset rendering parameter generating unit and a preset metadata generating unit. This will be explained with reference to FIG. **13** later.

The external preset information receiving unit **430** receives external preset information inputted from an external environment of the audio signal processing apparatus **400** according to one embodiment of the present invention. The external preset information includes a plurality of

external preset rendering parameters and a plurality of external preset metadatas corresponding to the external preset rendering parameters and is also able to include applied object number information indicating the number of objects to which the external preset rendering parameters are applied. A bitstream structure of the external preset information according to one embodiment of the present invention will be explained with reference to FIG. **9** later.

The external preset information applying-determining unit **440** receives the preset information inputted from the preset information generating unit **420** and the external preset information inputted from the external preset information receiving unit **430** and then determines whether to apply the external preset information. First of all, the external preset information applying-determining unit **440** receives applied object number information indicating the number of objects, to which the external preset information will be applied, from the applied object number information receiving unit **431** included in the external preset information receiving unit **430**. If the applied object number information is equal to the object number information included in the preset information through comparison, it is able to determine to use the external preset information preferentially.

If the applied object number information is different from the object number information, it is determined whether the preset information is included in a configuration information region of a bitstream or a data region thereof by extracting preset attribute information indicating an attribute of the preset information inputted from the preset information generating unit **420**. Preferably, the preset attribute information is used to determine whether the presser information is included in an extension region of the configuration information of the bitstream or an extension region of the data region [not shown in the drawing]. In this case, if it is determined that the preset information is included in the configuration information region of the bitstream, the static preset information receiving unit **450** is activated. If it is determined that the preset information is included in the data region of the bitstream, the dynamic preset information receiving unit **460** is activated.

Based on the preset attribute information, if the static preset information receiving unit **450** is activated (the case of preset_attribute_information=0 in Table 1), the preset information is inputted to the activated static preset information receiving unit **450** to operate. The static preset information receiving unit **450** can include a static preset metadata receiving unit receiving preset metadata corresponding to all data regions and a static preset information receiving unit receiving preset information. This will be explained in detail with reference to FIG. **13** later.

The dynamic preset information receiving unit **460** is activated if the preset attribute information indicates that the preset information is included in the data region (the case of preset_attribute_flag=1 in Table 1). The dynamic preset information receiving unit **460** is able to include a dynamic preset metadata receiving unit receiving preset metadata corresponding to the corresponding data region and a dynamic preset information receiving unit receiving preset information per data region. The dynamic preset metadata receiving unit receives and outputs selected preset metadata and the dynamic preset information receiving unit receives the preset information. This will be explained in detail with reference to FIG. **11** later.

The rendering unit **470** receives the downmix signal generated from downmixing the audio signal including a plurality of objects and the preset rendering parameter outputted from the static preset information receiving unit **450** or the dynamic preset information receiving unit **460**. Meanwhile, if the external preset information applying-determining unit **440** determines that the external preset information is applied, the rendering unit **470** receives an input of the external preset rendering parameter from the external preset rendering parameter receiving unit **432**. The preset information or the external preset rendering parameter is applied to the object included in the downmix signal, whereby a level or position of the object can be adjusted.

If the audio signal processing apparatus **400** includes a display unit [not shown in the drawing], the selected preset metadata outputted from the dynamic preset metadata receiving unit, the selected preset metadata outputted from the static preset metadata receiving unit or the selected external preset metadata outputted from the external preset metadata receiving unit **433** can be displayed on a screen of the display unit.

FIG. **5**A and FIG. **5**B are block diagrams for a method of applying preset information to a rendering unit according to an embodiment of the present invention. First of all, FIG. **5**A shows a method of applying preset information outputted from a static preset information receiving unit **450** to a rendering unit **570**. In this case, the static preset information receiving unit **450** is identical to the former static preset information receiving unit **450** shown in FIG. **4** and includes a static preset metadata receiving unit **451** and a static preset rendering parameter receiving unit **452**.

The static preset rendering parameter receiving unit **452** receives a preset rendering parameter for adjusting an object by being applied to all data regions of a downmix signal. In this case, the preset rendering parameter can include a rendering parameter included in one preset information selected from a plurality of preset informations. On the contrary, the static preset metadata receiving unit **451** receives preset metadata which indicates an attribute of the preset rendering parameter by corresponding to the one preset rendering parameter.

The static preset information receiving unit **450** receives and outputs the preset metadata and the preset rendering parameter corresponding to all data regions. And, the rendering unit **570** receives the preset rendering parameter.

The rendering unit **570** performs rendering per data region by receiving a downmix signal as well as the preset rendering parameter. The rendering unit **570** includes a data region **1** rendering unit **571**, a data region **2** rendering unit **572**, . . . and a data region n rendering unit **57***n*. In this case, rendering is performed in a manner that all data region rendering units **54**X of the rendering unit **570** equally apply the received preset rendering parameter to the downmix signal. For instance, if a preset rendering parameter outputted from the static preset rendering parameter receiving unit **452** is an external reset rendering parameter **2** indicating a karaoke mode, it is able to apply the karaoke mode to all data regions ranging from a first data region to an n^{th} data region.

FIG. **5**B shows a method of applying preset information outputted from a dynamic preset information receiving unit **460** to a rendering unit **570**. The dynamic preset information receiving unit **460** is identical to the former dynamic preset information receiving unit **460** shown in FIG. **4** and includes a dynamic preset metadata receiving unit **461** and a dynamic preset rendering parameter receiving unit **462**.

The dynamic preset information receiving unit **460** receives a preset rendering parameter from the dynamic preset rendering parameter per data region. The dynamic preset information receiving unit **460** receives and outputs

preset metadata from the dynamic preset metadata receiving unit **461**. The preset rendering parameter is then inputted to the rendering unit **570**.

The rendering unit **570** performs rendering per data region by receiving a downmix signal as well as the preset rendering parameter. The rendering unit **570** includes a data region **1** rendering unit **571**, a data region **2** rendering unit **572**, . . . and a data region n rendering unit **57***n*. In this case, each data region rendering units **54**X of the rendering unit **570** performs rendering by receiving and applying a preset rendering parameter corresponding to each data region to the downmix signal.

For instance, preset information_**1** of a concert hall mode is applied to a first data region. Preset information_**3** of a classic mode is applied to a second data region. Preset information_**2** of a karaoke mode can be applied to a sixth data region. In this case, 'n' of the preset information_n indicates an index of an external preset mode. And, it is understood that preset metadata corresponding to each preset rendering parameter is outputted per data region.

FIG. **6** is a block diagram for a method of applying external preset information to a rendering unit according to an embodiment of the present invention. First of all, an external preset information receiving unit **430** is identical to the former external preset information receiving unit **430** shown in FIG. **4** and includes an external preset metadata receiving unit **433** and an external preset rendering parameter receiving unit **432**.

The external preset rendering parameter receiving unit **432** receives a preset rendering parameter for adjusting an object by being applied to all data regions of a downmix signal. In this case, the external preset rendering parameter can include a rendering parameter included in one external preset information selected from a plurality of external preset informations. On the contrary, the external preset metadata receiving unit **433** receives external preset metadata which indicates an attribute of the external preset rendering parameter by corresponding to the one external preset rendering parameter.

The external preset information receiving unit **430** receives and outputs the external preset metadata and the external preset rendering parameter corresponding to all data regions. And, the rendering unit **670** receives the external preset rendering parameter.

The rendering unit **670** performs rendering per data region by receiving a downmix signal as well as the external preset rendering parameter. The rendering unit **670** includes a data region **1** rendering unit **671**, a data region **2** rendering unit **672**, . . . and a data region n rendering unit **67***n*. In this case, rendering is performed in a manner that all data region rendering units **64**X of the rendering unit **670** equally apply the received external preset rendering parameter to the downmix signal. For instance, if an external preset rendering parameter outputted from the external preset rendering parameter receiving unit **432** is an external reset rendering parameter **3** indicating a classic mode, it is able to apply the karaoke mode to all data regions ranging from a first data region to an n^{th} data region.

FIG. **7** is a block diagram for a schematic configuration of a static preset rendering parameter receiving unit **452** included in a static preset information receiving unit **450** of an audio signal processing apparatus **400**, a dynamic preset rendering parameter receiving unit **462** included in a dynamic preset information receiving unit **460** or an external preset rendering parameter receiving unit **432** included in an external preset information receiving unit **430**.

The dynamic/static/external preset rendering parameter receiving unit **452**/**462**/**432** includes an output channel information receiving unit **452***a*/**462***a*/**432***a* and a preset rendering parameter determining unit **452***b*/**462***b*/**432***b*. The output channel information receiving unit **452***a*/**462***a*/**432***a* receives and outputs output channel number information indicating the number of output channels from which an object included in a downmix signal will be outputted. In this case, the output channel number information may indicate a mono channel, a stereo channel or a multi-channel (5.1 channel), by which the present invention is non-limited.

The preset rendering parameter determining unit **452***b*/**462***b*/**432***b* receives and outputs a corresponding preset rendering parameter or a corresponding external preset rendering parameter based on the output channel number information inputted from the output channel information receiving unit **452***a*/**462***a*/**432***a*. In this case, the external preset rendering parameter may include one of a mono external preset rendering parameter, a stereo external preset rendering parameter, and a multi-channel external preset rendering parameter. And, the preset rendering parameter may include one of a mono preset rendering parameter, a stereo preset rendering parameter, and a multi-channel preset rendering parameter. In case that the preset rendering parameter or the external preset rendering parameter is a matrix type, its dimension can be determined based on the number of objects and the number of output channels. And, the preset matrix or the external preset matrix can have a form of (No. of objects)*(No. of output channels). For instance, when there are n objects included in a downmix signal, if the output channels from the output channel information receiving unit **452***a*/**462***a*/**432***a* correspond to the 5.1 channel (i.e., 6 channels), the preset rendering parameter determining unit **452***b*/**462***b*/**432***b* can output a multi-channel preset rendering parameter or a multi-channel external preset rendering parameter implemented in form of n*6. In this case, an element of the matrix is a gain value that indicates an extent that an a^{th} object is included in an i^{th} channel.

FIG. **8** is a block diagram of an audio signal processing apparatus **800** according to another embodiment of the present invention. Referring to FIG. **8**, an audio signal processing apparatus **800** mainly includes a downmixing unit **810**, an object information generating unit **820**, a preset information generating unit **830**, a downmix signal processing unit **840**, an information processing unit **850** and a multi-channel decoding unit **860**.

A plurality of objects (object **1**, object **2**, . . . object n) are inputted to the downmixing unit **810** to generate a mono or a stereo downmix signal. Moreover, a plurality of the objects are inputted to the object information generating unit **820** to generate object level information indicating a level of object and a gain value of object included in a downmix signal. In case of a stereo downmix signal, the object information generating unit **820** generates object gain information indicating an extent of object included in a downmix channel, object correlation information indicating a presence or non-presence of correlation between objects and the like. Subsequently, the downmix signal and the object information are inputted to the preset information generating unit **830**. The preset information generating unit **830** then generates preset attribute information indicating whether the preset information is included in a data region of a bitstream or a configuration information region of the bitstream and preset information including a preset rendering parameter previously set to perform rendering to adjust a level or position of object and preset metadata for representing the preset

rendering parameter. As mentioned in the foregoing description of the audio signal processing apparatus and method shown in FIGS. **1** to **4**, the process for generating the preset attribute information, the preset rendering parameter and the preset metadata follows the same description thereof.

Moreover, the preset information generating unit **830** is able to further generate preset presence information indicating whether preset information exists in a bitstream, preset number information indicating the number of preset informations, and preset metadata length information indicating a length of preset metadata. The object information generated by the object information generating unit **820** and the preset attribute information, preset information, preset metadata, preset presence information, preset number information and preset metadata length information generated by the preset information generating unit **830** can be transferred by being included in a SAOC bitstream or can be transferred in form of one bitstream in which a downmix signal is included as well. In this case, the bitstream including the downmix signal and the preset relevant informations can be inputted to a signal receiving unit (not shown in the drawing) of a decoding apparatus.

The information processing unit **850** includes an object information processing unit **851**, an external preset information receiving unit **852**, an external preset information application determining unit **853**, a static preset information receiving unit **852** and a dynamic preset information receiving unit **853** and receives the SAOC bitstream. As mentioned in the foregoing description with reference to FIGS. **1** to **7**, whether the static preset information receiving unit **852** or the dynamic preset information receiving unit **853** is activated is determined based on the preset attribute information included in the SAOC bitstream.

The external preset information receiving unit **852** receives external preset information inputted from an external environment of the audio signal processing apparatus **800** according to one embodiment of the present invention. The received external preset information is inputted to the external preset information application determining unit **853** to determine whether the external preset information will be used to adjust an object.

In case of using the external preset information, the external preset information received by the external preset information receiving unit **852** is directly inputted to the object information processing unit **851**. On the contrary, in case of using the preset information included in the SAOC bitstream, the preset information is inputted to the static preset information receiving unit **854** or the dynamic preset information receiving unit **855** based on the preset attribute information included in the SAOC bitstream.

The static preset information receiving unit **854** or the dynamic preset information receiving unit **855** receives the above described preset attribute information via the SAOC bitstream. And, the external preset information receiving unit **852** receives the external preset presence information, the external preset number information, the external preset metadata, the output channel information and the external preset rendering parameter (e.g., external preset matrix). And, methods according to the various embodiments described in the audio signal processing method and apparatus shown in FIGS. **1** to **7** are used.

The static preset information receiving unit **854**, the dynamic preset information receiving unit **855** or the external preset information receiving unit **852** outputs the preset metadata and preset rendering data received via the SAOC bitstream or the external preset metadata and the external preset information received via the external bitstream. The object information processing unit **851** then receives the outputted data and information to generate downmix processing information for pre-processing a downmix signal and multi-channel information for upmixing the pre-processed downmix signal using the downmix processing unit in a manner of using the outputted data and information together with the object information included in the SAOC bitstream.

In doing so, the preset rendering parameter and preset metadata outputted from the static preset information receiving unit **854** and the external preset rendering parameter and external preset metadata outputted from the external preset information receiving unit **852** correspond to all data regions. And, the preset information and preset metadata outputted from the dynamic preset information receiving unit **855** correspond to one of the data regions.

Subsequently, the downmix processing information is inputted to the downmix signal processing unit **840** to vary a channel in which an object contained in the downmix signal is included. Therefore, it is able to perform panning. Thus, the pre-processed downmix signal is inputted to the multi-channel decoding unit **860** together with the multi-channel information outputted from the information processing unit **850**. It is then able to generate a multi-channel audio signal by upmixing the inputted the pre-processed downmix signal and the multi-channel information together.

In decoding a downmix signal including a plurality of objects into a multi-channel signal using multi-channel information, an audio signal processing apparatus according to another embodiment of the present invention is facilitated to adjust a level of object using external preset rendering parameter and external preset metadata separately inputted as a bitstream from an external environment.

FIG. **9** is a diagram for a bitstream structure of external preset information according to one embodiment of the present invention.

Referring to FIG. **9**, for compatibility with an SAOC bitstream, external preset information includes a file ID **910**, an external preset rendering parameter **920** and an external preset metadata **930**.

In order to determine whether external preset information can be applied to a downmix signal, i.e., whether synchronization with an SAOC bitstream is possible, the file ID **910** can include object number information indicating the number of objects to which the external preset information is applied. Moreover, the file ID **910** can include a sync word separately defined for synchronization, can further include external preset number information indicating the number of external preset informations, and can include an identifier set to enable external preset information to be preferentially used irrespective of the applied object number.

The external preset rendering parameter **920** can contain such a content as a preset rendering parameter included in the SAOC bitstream and is able to include the various external preset rendering parameters described with reference to FIG. **3**. The external preset rendering parameter **920** can include rendering data of a user setting type as well as a matrix type rendering parameter. And, the external preset rendering parameter **920** can further include output channel information indicating the number of external preset informations and the number of output channels.

Meanwhile, the external preset metadata **930** includes metadata corresponding to the external preset rendering parameter **920**.

FIGS. **10** to **12** are various diagrams for syntax related to preset invention according to another embodiment of the present invention.

Referring to FIG. **10**, it is able to configure preset information to be included in an extension region of configuration information.

A configuration information region SAOCSpecificConfig ( ) of a bitstream has an extension region SAOCExtensionConfig( ). If preset information is received, it can be indicated by a container type of SAOCExtensionConfig(9) and its meaning is disclosed in Table 2. In FIG. **10**, an extension region of the SAOCExtensionConfig(9) includes preset information PresetConfig( ).

TABLE 2

SAOCExtensionConfig( )	Meaning
SAOCExtensionConfig(9)	Indicating that preset information is included in an extension region of configuration information

The preset information PresetConfig( ), as shown in FIG. **10**, can include preset number information bsNumPresets indicating the number of preset informations, preset metadata length information bsNumCharPresetLabel [i] indicating the number of bytes for representing preset metadata indicating an attribute of the preset information, and a matrix type preset rendering parameter bsPresetMatrix indicating the preset metadata bsPresetLabel [i] [j] and rendering data.

Thus, it is facilitated to play back an audio signal by rendering the audio signal using preset information included in a configuration information region of a bitstream.

On the other hand, referring to FIG. **11**, the preset information can be included in an extension region of a data region instead of a configuration information region. A data region SAOCFrame( ) has an extension region SAOCExtensionFrame( ). And extension region SAOCExtensionFrame(9) for preset information can include such preset information as the preset information PresetConfig( ) shown in FIG. **8**. And, the meaning of the extension region of the data region is disclosed in Table 3.

In case that the aforesaid external preset information described with reference to FIGS. **1** to **9** is used, corresponding informations included in the external preset information are extracted instead of the preset information PresetConfig( ) shown in FIG. **10** or FIG. **11** and can be used to adjust an object included in a downmix signal.

TABLE 3

SAOCExtensionFrame( )	Meaning
SAOCExtensionFrame(9)	Indicating that preset information is included in an extension region of a data region

Meanwhile, the extension region of the data region in FIG. **11** can include information, which needs to be updated per data region, such as a preset rendering parameter and the like, as shown in the SAOCExtensionFrame( ) syntax. In this case, a preset rendering parameter PresetMatrixDate( ), which is substantial rendering data, includes values, which are not updated, such as a rendering parameter type bsPresetMatrixType indicating a type of the preset rendering parameter.

Hence, FIG. **12** proposes a syntax according to a further embodiment of the present invention. Referring to FIG. **12**, an extension region SAOCExtensionFrame(9) of a data region includes a preset rendering parameter bsPresetMatrixElements [i] [j] only.

Thus, an audio signal processing method according to one embodiment of the present invention enables non-updated informations to be included in a configuration information region, thereby reducing the number of bits transported for preset information.

FIG. **13** is a block diagram of an audio signal processing apparatus according to a further embodiment of the present invention. First of all, an audio signal processing apparatus **1300** mainly includes a preset information generating unit **1310**, a preset attribute receiving unit **1315**, an external preset information receiving unit **1320**, an external preset applicability determining unit **1325**, an applied preset inputting unit **1330**, an applied preset selecting unit **1335**, a preset information inputting unit **1340**, a preset information selecting unit **1345**, a static preset information receiving unit **1350**, a dynamic preset information receiving unit **1355**, a rendering unit **1360** and a display unit **1365**.

The preset attribute receiving unit **1315**, external preset information receiving unit **1320**, static preset information receiving unit **1350**, dynamic preset information receiving unit **1355** and rendering unit **1360** in FIG. **13** have the same configurations and functions of the former preset attribute receiving unit **1315**, external preset information receiving unit **1320**, static preset information receiving unit **1350**, dynamic preset information receiving unit **1355** and rendering unit **1360** in FIG. **4** and heir details are omitted in the following description.

Referring to FIG. **13**, the preset information generating unit **1310** includes a preset attribute determining unit **1311**, a preset metadata generating unit **1312** and a preset rendering parameter generating unit **1313**.

As mentioned in the foregoing description, the preset attribute determining unit **1311** determines preset attribute information indicating whether preset information will be applied to all data regions by being included in a configuration information region or the preset information will be applied per data region by being included in a data region. Subsequently, the preset metadata generating unit **1312** and the preset rendering parameter generating unit **1313** are able to generate one preset metadata and one preset rendering parameter or preset metadata and preset rendering parameters as many as the number of data regions.

The preset metadata generating unit **1312** receives text information indicating the preset rendering parameter and is then able to generate preset metadata. On the other hand, if a gain for adjusting a level of the object and/or a position of the object is inputted to the preset rendering parameter generating unit **1313**, it is able to generate a preset rendering parameter that will be applied to the object. It is able to generate the preset rendering parameter to apply to each object. Various types of the preset rendering parameter can be implemented. For instance, the preset rendering parameter can be implemented as a channel level difference (CLD) parameter, a matrix or the like.

The preset rendering parameter generating unit **1313** is able to further generate output channel information indicating how many output channels of the object exist. The preset metadata generated by the preset metadata generating unit **1312**, the preset rendering parameter generated by the preset rendering parameter generating unit **1313** and the output channel information generated by the preset rendering parameter generating unit **1313** can be transported by being included in one bitstream. In particular, they can be transported by being included in an ancillary region of a bitstream including a downmix signal or by being included in a bitstream separate from a downmix signal.

Meanwhile, the preset information generating unit **1310** is able to further generate preset presence information indicating that the preset metadata, the preset rendering parameter and the output channel information are included in a bitstream. In this case, the preset presence information can have a container type indicating the preset information or the like is included in which region of a bitstream or a flag type simply indicating whether the preset information or the like is included in a bitstream, by which the present invention is non-limited.

The preset information generating unit is able to generate a plurality of preset informations. And, each of a plurality of the preset informations includes the preset rendering parameter, the preset metadata and the output channel information. In this case, preset information generating unit is able to further generate preset number information indicating the number of the preset informations.

Thus, the preset information generating unit is able to generate and output preset attribute information, preset metadata and preset rendering parameter in a form of a bitstream.

The preset attribute receiving unit **1315** receives and outputs preset attribute information received from the preset information generating unit **1310**. And, the meaning of the preset attribute information is disclosed in the aforesaid Table 1.

The external preset applicability determining unit **1325** receives an input of external preset information from the external preset information receiving unit **1320** and is then able to determine whether the external preset information is applicable to a downmix signal based on object number information included in the external preset information. The external preset information can have the bitstream structure shown in FIG. **9**. Moreover, the external preset information has the same configurations and function of a preset rendering parameter, preset metadata, preset presence information, preset number information, object number information and output channel information, which are included in preset information inputted from an encoder. And, the external preset information can include external preset rendering parameter, external preset metadata, external preset presence information, external preset number information, object number information and output channel information, which are included in a bitstream inputted not from an encoder but from an external environment.

If the object number information is equal to the number of objects included in the downmix signal, the external preset information is applicable to the downmix signal. If the object number information is different from the number of objects included in the downmix signal, the external preset information is not used.

If the external preset applicability determining unit **1325** determines that the external preset information is used, the applied preset inputting unit **1330** displays metadata for determining whether to use the external preset information or the preset information to adjust an object and is then able to received an input of a selection signal for selecting information to use. According to another embodiment of the present invention, if the external preset applicability determining unit **1325** determines that the external preset information is usable, external preset information is preferentially usable by omitting this step.

If the external preset applicability determining unit **1325** determines that the external preset information is usable, the applied preset selecting unit **1335** receives preset information from the preset information from the preset information receiving unit **1310** and also receives external preset information from the external preset applicability determining unit **1325**. And, the applied preset selecting unit **1335** is able to select and output the preset information or the external preset information indicated by the selection signal inputted from the applied preset inputting unit **1330**.

If the preset information is selected by the applied preset selecting unit **1335**, it is able to adjust an object in a manner that the preset information is applied to a data region of a downmix signal corresponding to an extension region having the preset information included therein or all data regions based on the preset attribute information outputted from the preset attribute receiving unit **1315**. On the contrary, if the external preset information is selected by the applied preset selecting unit **1335**, the external preset information is equally applied to all data regions of the downmix signal irrespective of the preset attribute information outputted from the preset attribute receiving unit **1315**.

If the external preset information is selected by the applied preset selecting unit **1335** based on the selection signal inputted from the applied preset inputting unit **1330**, the preset information inputting unit **1340** firstly displays a plurality of external preset metadatas received from the external preset metadata receiving unit **1321** on a screen of a display unit **1365** and then receives an input of a selection signal for selecting one of a plurality of the external preset metadatas. The preset information selecting unit **1345** selects one external preset metadata selected by the selection signal and an external preset rendering parameter corresponding to the external preset metadata.

In case that external preset information is used, the static preset information receiving unit **1350** is activated only. The external preset metadata selected by the selection signal and the external preset rendering parameter corresponding to the external preset metadata are inputted to the static preset metadata receiving unit **1351** and the static preset rendering parameter receiving unit **1352** of the static preset information receiving unit **1350**, respectively. In this case, the display unit **1365**, the preset information inputting unit **1340** and the preset information selecting unit **1345** can perform the operation once only.

On the contrary, if the applied preset selecting unit **1335** determines to use the preset information inputted from the preset information generating unit **1310**, the static preset information receiving unit **1350** or the dynamic preset information receiving unit **1355** are activated according to the preset attribute information received from the preset attribute receiving unit **1315**.

In this case, if the preset attribute information received from the preset attribute receiving unit **1315** indicates that the preset information is included in an extension region of a configuration information region, preset metadata selected by the preset information selecting unit **1345** and the preset rendering parameter corresponding to the preset metadata are inputted to the preset metadata receiving unit **1351** and the preset rendering parameter receiving unit **1352** of the static preset information receiving unit **1350**.

On the contrary, if the preset attribute information received from the preset attribute receiving unit **1315** indicates that the preset information is included in an extension region of a data region, preset metadata selected by the preset information selecting unit **1345** and preset rendering parameter information corresponding to the preset metadata are inputted to the preset metadata receiving unit **1356** and the preset rendering parameter receiving unit **1357** of the dynamic preset information receiving unit **1355**. In this case, the display unit **1365**, the preset information inputting unit

1340 and the preset information selecting unit 1345 can perform the above operation repeatedly as many as the number of data regions.

Moreover, the selected external preset rendering parameter or the selected preset rendering parameter is outputted to the rendering unit 1360, while the selected external preset metadata or the selected preset rendering parameter is outputted to the display unit 1365 to be displayed on the screen of the display unit 1365. The display unit 1365 may include the same unit for displaying a plurality of preset metadatas or external preset metadatas to enable the preset information inputting unit 1340 to receive an input of a selection signal or can include a different unit. If the display unit 1365 and a display unit for displaying the preset metadata or the external preset metadata for the preset information inputting unit 1340 use the same unit, it is able to discriminate each action in a manner that a description (e.g., 'Please select preset information.', 'Preset information N is selected.', etc.), a visual object, letters and the like are configured different on the screen.

FIG. 14 is a diagram for a display unit 1365 of an audio signal processing apparatus 1400. First of all, a display unit 1365 can include at least one or more graphical objects indicating levels or positions of objects adjusted using selected preset metadata or external preset metadata and preset rendering parameter/external preset rendering parameter corresponding to the preset metadata/external preset metadata. Referring to FIG. 14, in case that a news mode is selected via the preset information selecting unit 1340 from a plurality of preset metadatas or external preset metadatas (e.g., stadium mode, cave mode, news mode, live mode, etc.) displayed on the outputting unit 1365 shown in FIG. 13, a preset rendering parameter or an external preset rendering parameter corresponding to the news mode is applied to each object included in a downmix signal. In this case, a level of vocal will be raised, while levels of other objects (guitar, violin, drum, . . . cello) will be lowered.

The graphical object included in the display unit 1365 is transformed to indicate activation or change of the level or position of the corresponding object. For instance, referring to FIG. 14, a switch of a graphical object indicating a vocal is shifted to the right, while switches of graphical objects indicating the reset of the objects are shifted to the left.

The graphical object is able to indicate a level or position of an object adjusted using a preset rendering parameter or an external preset rendering parameter in various ways. At least one graphical object indicating each object can exist. In this case, a first graphical object indicates a level or position of an object prior to applying the preset rendering parameter or the external preset rendering parameter. And, a second graphical object is able to indicate a level or position of an object adjusted by applying the preset rendering parameter or the external preset rendering parameter. In this case, it is facilitated to compare levels or positions of an object before and after applying the preset rendering parameter or the external preset rendering parameter. Therefore, a user is facilitated to be aware how the preset information or the external preset information adjusts each object.

FIG. 15 is a diagram of at least one graphical object for displaying objects, to which preset information or external preset information is applied, according to a further embodiment of the present invention. Referring to FIG. 15, a first graphical object is a bar type and a second graphical object can be represented as an extensive line within the first graphical object. In this case, the first graphical object indicates a level or position of an object prior to applying preset information or external preset information to the object. And, the second graphical object indicates a level or position of an object adjusted by applying preset information or external preset information to the object.

In FIG. 15, a graphical object in an upper part indicates a case that a level of an object prior to applying preset information or external preset information is equal to that after applying preset information or external preset information. A graphical object in a middle part indicates that a level of an object adjusted by applying preset information or external preset information is greater than that prior to applying preset information or external preset information. And, a graphical object in a lower part indicates that a level of an object is lowered by applying preset information or external preset information.

Thus, using at least one or more graphical objects indicating levels or positions of objects before and after applying preset information or external preset information, a user is facilitated to be aware that how preset information or external preset information adjusts each object. Moreover, since a user is able to easily recognize a feature of preset information or external preset information, the user is facilitated to select suitable preset information or external preset information if necessary.

FIG. 16 is a schematic diagram of a product including an external preset information receiving unit, an external preset information application determining unit, a static preset information receiving unit, a dynamic preset information receiving unit and a rendering unit according to one embodiment of the present invention, and FIG. 17A and FIG. 17B are schematic diagrams for relations of products, each of which includes an external preset information receiving unit, an external preset information application determining unit, a static preset information receiving unit, a dynamic preset information receiving unit and a rendering unit, according to another embodiment of the present invention.

Referring to FIG. 16, a wire/wireless communication unit 1610 receives a bitstream by wire/wireless communications. In particular, the wire/wireless communication unit 1610 includes at least one of a wire communication unit 1616, an infrared communication unit 1612, a Bluetooth unit 1613 and a wireless LAN communication unit 1614.

A user authenticating unit 1620 receives an input of user information and then performs user authentication. The user authenticating unit 1620 can include at least one of a fingerprint recognizing unit 1621, an iris recognizing unit 1622, a face recognizing unit 1623 and a voice recognizing unit 1624. In this case, the user authentication can be performed in a manner of receiving an input of fingerprint information, iris information, face contour information or voice information, converting the inputted information to user information, and then determining whether the user information matches registered user data.

An inputting unit 1630 is an input device enabling a user to input various kinds of commands. And, the inputting unit 1630 can include at least one of a keypad unit 1631, a touchpad unit 1632 and a remote controller unit 1633, by which examples of the inputting unit 1630 are non-limited.

Meanwhile, if information for selecting information to use from external preset information inputted from an external preset information receiving unit 1642 and preset information inputted from the wire/wireless communication unit 1610 is displayed on a screen via a display unit 1662, a user is able to input a selection signal via the inputting unit 1630. And, the selected external preset information (or, preset information) selected based on the selected signal is inputted to a control unit 1650. Moreover, if external preset metadata for a plurality of external preset rendering parameters out-

putted from the metadata receiving unit **1641** are displayed on the screen of the display unit **1662**, a user is able to select the external preset metadata via the inputting unit **1630**. And, information on the selected external preset metadata is inputted to the control unit **1650**.

A signal decoding unit **1640** includes an external preset information receiving unit **1641**, an external preset information application determining unit **1642**, a static preset information receiving unit **1643**, a dynamic preset information receiving unit **1644** and a rendering unit **1645**. Since they have the same configurations and functions of the former external preset information receiving unit **430**, external preset information application determining unit **440**, static preset information receiving unit **450** and dynamic preset information receiving unit **460** shown in FIG. **4**, their details are omitted in the following description.

A control unit **1650** receives input signals from the input devices and controls all processes of the signal decoding unit **1640** and an outputting unit **1660**. As mentioned in the foregoing description, if information on the preset metadata or external preset metadata selected by the inputting unit **1630** and a type of the selected preset information or external preset information are inputted as a selection signal to the control unit **1650** and if preset attribute information (preset_attribute_information) indicating that preset information is included in which region of a bitstream is inputted from the wire/wireless communication unit **1610**, the static preset information receiving unit **1643** and the dynamic preset information receiving unit **1644** receive preset rendering parameters corresponding to the selected preset metadata and then decode an audio signal using the received parameters, based on the preset attribute information and the selection signal.

Meanwhile, if the external preset information is determined to use, an external preset rendering parameter corresponding to the selected external preset metadata is inputted to the dynamic preset information receiving unit **1643** based on the selection signal irrespective of the preset attribute information.

And, an outputting unit **1660** is an element for outputting an output signal and the like generated by the signal decoding unit **1640**. The outputting unit **1660** can include a speaker unit **1661** and a display unit **1662**. If an output signal is an audio signal, it is outputted via the speaker unit **1661**. If an output signal is a video signal, it is outputted via the display unit **1662**. Moreover, the outputting unit **1660** displays the preset metadata or external preset metadata selected by the control unit **1650** on a screen via the display unit **1662**.

FIG. **17**A and FIG. **17**B show the relations between a terminal and a server, which correspond to the product shown in FIG. **11**.

Referring to FIG. **17**A, it can be observed that bidirectional communications of data or bitstreams can be performed between a first terminal **1710** and a second terminal **1720** via wire/wireless communication units. The data or bitstream exchanged via the wire/wireless communication units may include one of the bitstreams shown in FIG. **1**A, FIG. **1**B, FIG. **2** and FIG. **9** or the data including the preset attribute information, preset rendering parameter, preset metadata, external preset rendering parameter, external preset metadata and the like of the present invention described with reference to FIGS. **1** to **16** of the present invention.

Referring to FIG. **17**B, it can be observed that wire/wireless communications can be performed between a server **1730** and a first terminal **1740**.

FIG. **18** is a schematic block diagram of a broadcast signal decoding apparatus **1800** in which an audio decoder including a preset attribute determining unit, an external preset information receiving unit, a static or dynamic preset information receiving unit and a rendering unit according to one embodiment of the present invention is implemented.

Referring to FIG. **18**, a demultiplexer **1820** receives a plurality of datas related to a TV broadcast from a tuner **1810**. The received data are separated by the demultiplexer **1820** and are then selected by a data decoder **1830**. Meanwhile, the data selected by the demultiplexer **1820** can be stored in such a storage medium **1850** as an HDD.

The data selected by the demultiplexer **1820** are inputted to a decoder **1840** including an audio decoder **1841** and a video decoder **1842** to be decoded into an audio signal and a video signal. The audio decoder **1841** includes an external preset information receiving unit **1841***a*, an external preset information application determining unit **1841***b*, a static preset information receiving unit **1841***c*, a dynamic preset information receiving unit **1841***d* and a rendering unit **1841***e* according to one embodiment of the present invention. Since they have the same configurations and functions of the external preset information receiving unit **430**, external preset information application determining unit **440**, static preset information receiving unit **450** and dynamic preset information receiving unit **460**, their details are omitted in the following description.

The signal decoding unit **1841** generates an output signal by decoding an audio signal using the received bitstream, preset metadata (or external preset metadata) and preset rendering parameter (or external preset rendering parameter) and then outputs a text type of the preset metadata or the external preset metadata.

A display unit **1870** visualizes or displays the video signal outputted from the video decoder **1842** and the external preset metadata outputted from the audio decoder **1841**. The display unit **1870** includes a speaker unit (not shown in the drawing). And, an audio signal, in which a level of an object outputted from the audio decoder **1841** is adjusted using the external preset information, is outputted via the speaker unit included in the display unit **1870**. Moreover, the data decoded by the decoder **1840** can be stored in the storage medium **1850** such as the HDD.

Meanwhile, the signal decoding apparatus **1800** can further include an application manager **1860** capable of controlling a plurality of datas received by having information inputted from a user. The application manager **1860** includes a user interface manager **1861** and a service manager **1862**. The user interface manager **1861** controls an interface for receiving an input of information from a user. For instance, the user interface manager **1861** is able to control a font type of text visualized on the display unit **1870**, a screen brightness, a menu configuration and the like. Meanwhile, if a broadcast signal is decoded and outputted by the decoder **1840** and the display unit **1870**, the service manager **1862** is able to control a received broadcast signal using information inputted by a user. For instance, the service manager **1862** is able to provide a broadcast channel setting, an alarm function setting, an adult authentication function, etc. The data outputted from the application manager **1860** are usable by being transferred to the display unit **1870** as well as the decoder **1840**.

Accordingly, the present invention provides the following effects or advantages.

First of all, the present invention individually selects to apply preset information by a data region (or frame unit) or

selects to apply the same preset information to a whole downmix signal, thereby efficiently reconstructing an audio signal.

Secondly, the present invention selects one of a plurality of external preset rendering parameters using external preset metadata as well as previously set preset information without users' setting of each object, thereby facilitating to adjust a level of an output channel of an object.

Thirdly, the present invention selects more suitable external preset information by checking an object controlled by having external preset information applied thereto and selected preset metadata, thereby adjusting a level or position of an output channel of an object.

What is claimed is:

1. A method of processing an audio signal, comprising:

receiving a downmix signal and object information, the downmix signal including at least one object, and the object information indicating an attribute of the object;

receiving applied object number information, the applied object number information indicating the number of objects to which the external preset information is applied;

receiving external preset information based on the applied object number information, the external preset information including external preset rendering parameter and external preset metadata;

generating downmix processing information controlling panning or gain of the downmix signal by using the object information and the external preset information; and

modifying the downmix signal by using the downmix processing information.

2. The method of claim **1**, wherein the external preset rendering parameter renders the object being included in the downmix signal and the external preset metadata indicates attribute of the external preset rendering parameter.

3. The method of claim **1**, wherein the external preset rendering parameter comprises an external preset matrix based on output channel information indicating the number of output channel of the downmix signal and the applied object number information.

4. The method of claim **1**, wherein first information further includes preset information being used to adjust a level or panning of the at least one object,

wherein the generating the downmix processing information by using the external preset information based on the applied object number information or the preset information based on the preset attribute information.

5. The method of claim **1**, wherein the external preset rendering parameter comprises an external mono preset rendering parameter, an external stereo preset rendering parameter and an external multi-channel preset rendering parameter, according to the number of output channel of the downmix signal.

6. The method of claim **4**, wherein the first information further includes preset attribute information indicating whether the preset information is applied to a data region or all data regions of the downmix signal,

wherein the preset information is included in a configuration information region or preset information is included in a data region,

wherein if the preset information is included in the configuration information region, the preset information is applied to all data regions to which the preset information is applied, and

wherein if the preset information is included the data region, the preset information is applied to corresponding data region.

7. An apparatus for processing an audio signal, the apparatus comprising:

a signal receiving unit configured to receive a downmix signal and object information, the downmix signal including at least one object, the object information indicating an attribute of the object;

an external preset information receiving unit configured to:

receive applied object number information, the applied object number information indicating the number of object to which the external preset information is applied, and

receive external preset information based on the applied object number information, the external preset information including external preset rendering parameter and external preset metadata;

an information processing unit configured to generate downmix processing information controlling panning or gain of the downmix signal by using the object information and the external preset information; and

a downmix signal processing unit configured to modify the downmix signal by using the downmix processing information.

8. The apparatus of claim **7**, wherein the external preset rendering parameter renders the object being included in the downmix signal and the external preset metadata indicates attribute of the external preset rendering parameter.

9. The apparatus of claim **7**, wherein the external preset rendering parameter comprises an external preset matrix based on output channel information indicating the number of output channel of the downmix signal and the applied object number information.

10. The apparatus of claim **7**, wherein the external preset information receiving unit comprises an external preset rendering parameter receiving unit receiving an external preset rendering parameter and an external preset metadata receiving unit receiving external preset metadata.

11. The apparatus of claim **7**, wherein first information further includes preset information being used to adjust a level or panning of the at least one object,

wherein the information processing unit generating the downmix processing information by using the external preset information based on the applied object number information or the preset information based on the preset attribute information.

12. The apparatus of claim **11**, wherein the first information further includes preset attribute information indicating whether the preset information is applied to a data region or all data regions of the downmix signal, wherein the preset information is included in a configuration information region or preset information is included in a data region,

wherein if the preset information is included in the configuration information region, the preset information is applied to all data regions to which the preset information is applied, and

wherein if the preset information is included the data region, the preset information is applied to corresponding data region.

* * * * *